**PATENT**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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| Title: | METHOD FOR SURFACE POLISHING OF AN OPTICAL ARTICLE USING A SOLVENT OR A MIXTURE OF SOLVENTS |
| Appl. No.: | 10/068,232 |
| Appellant: | Prieur-Blanc *et al.* |
| Filed: | February 6, 2002 |
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March 15, 2007
Date

Michael R. Krawzsenek

# APPEAL BRIEF

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## I. REAL PARTY IN INTEREST

The real party in interest is the assignee, Essilor International Compagnie Generale d'Optique, Charenton cedex, France.

## II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

## III. STATUS OF THE CLAIMS

Claims 1-17 were originally filed. Claims 1-17 were canceled and claims 18-34 were added in a Response to Office Action filed on June 28, 2004.

Claims 18-34 are pending, stand rejected, and are appealed (see Claims Appendix).

## IV. STATUS OF AMENDMENTS

No amendments to the claims or specification have been made by Appellant subsequent to the June 15, 2006 Final Office Action.

## V. SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 18 is directed to a method of surface polishing of at least one principal surface of an optical article made from transparent thermoplastic material. The method comprises the successive steps of: grinding; fine grinding; and polishing, wherein the fine grinding and/or the polishing comprises attacking the principal surface of the article with a solvent or a mixture of organic solvents and not with a non-solvent of the transparent thermoplastic material. Non-limiting examples of support for independent claim 18 can be found in the specification at: page 2, line 30 to page 5, line 14.

## VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 18-34 are rejected under 35 U.S.C. §112, first paragraph as failing to comply with the written description requirement. Claims 18-34 are also rejected under 35 U.S.C. §103(a) as being unpatentable over statements made in Appellant's specification at page 1, line 7 to page 2, line 11, in view of U.S. Patent No. 4,376,751 to Duchane *et al.* (Evidence Appendix 1).

## VII. ARGUMENT

### A. Summary of Appellant's Arguments

Throughout the prosecution of this application, the Examiner has consistently ignored well-settled legal precedent and the guidelines set forth in the *Manual of Patent Examining Procedure* to sustain the current rejections. Instead, the Examiner appear to use his own subjective standards in an effort to support the baseless written description and obviousness rejections.

#### 1. A Brief Explanation of Why the Written Description Rejection Is Improper

The written description rejection is based on the negative limitation in claim 18 "and not with a non-solvent." Instead of following the well-settled "objective standard" for determining compliance with the written description requirement (*i.e.*, "does the description clearly allow persons of ordinary skill in the art to recognize that he or she invented what is claimed"—see MPEP 2163.01), the Examiner makes the following statement which is based on his own subjective belief:

> While applicant admittedly has support for the mixture of solvents to contain a non-solvent (page 5, lines 1-5), this would appear to be more an afterthought based on the disclosure of the admitted prior art (i.e., page 2, lines 20-21 which in fact is the Duchane et al reference applied against the claims) rather than an alternate embodiment.

June 15, 2006 Final Office Action at page 2 (Evidence Appendix 2).

Contrary to the Examiner's subjective beliefs, Appellant's specification provides clear and objective support for the claimed element "attacking the principal surface of the article with a solvent or a mixture of organic solvents and not with a non-solvent." For instance, the specification contemplates that "up to 20% by weight" of a non-solvent can be used in the context of the present invention:

> The solvent or mixture of solvents of the thermoplastic material to be treated **may** contain, in limited proportion, **up to 20% by weight**, preferably up to 15% by weight of an organic diluent **which is not a solvent** of the thermoplastic material to be treated. An example of such an organic diluent is ethylene glycol diacetate.
>
> In the attack step, **the solvent or mixture of solvents is preferably pure**, in other words it **contains only the solvent or mixture of solvents** and during the attack on the article, in particular a polycarbonate article, only the thermoplastic material of the article is dissolved in this solvent or these solvents.

Appellant's specification at page 5, lines 6-14 (emphasis added).

A person of ordinary skill in the art, upon reading the above language, would reach at least the following three conclusions. First, the solvent or mixture of solvents "may" include a non-solvent. Stated another way, the use of the term "may" objectively confirms that the use of a non-solvent is a positive recitation of an alternative embodiment of the present invention. MPEP § 2173.05(i) ("If alternative elements are positively recited in the specification, they may be explicitly excluded in the claims.").

Second, the phrase "up to 20% by weight" encompasses 0% up to 20% by weight of a non-solvent. *See, e.g., In re Mochel*, 470 F.2d 638, 640 (CCPA 1974) ("As this Court has held, the phrase 'up to' of claim 2 includes zero as the lower limit."); *Ex parte Khusid*, 174 U.S.P.Q. 59 (Bd. App. 1971) (explaining that "a moisture content of not more than 70% by weight" reads on dry material). Stated another way, a person of ordinary skill in the art would objectively reason that 0% of a non-solvent mean "and not with a non-solvent." *Ex parte Parks*, 30 U.S.P.Q.2d 1234, 1236 (Bd. App. 1993) (in reversing the examiner's written description

rejection based on the negative limitation "in the absence of a catalyst," the Board explained "...it cannot be said that the originally-filed disclosure would not have conveyed to one having ordinary skill in the art that appellants had possession of the concept of conducting the decomposition step generating nitric acid in the absence of a catalyst.").

Third, the phrase "the solvent or mixture of solvents is preferably pure" encompasses a solvent or a mixture of solvents that do not include non-solvents. If the substance used in the attacking step contains only a solvent or mixture of solvents, then by definition it does not include a non-solvent. In fact, the Example on pages 12-14 of Appellant's specification confirms that optical articles (*e.g.*, lenses) can be polished by using pure solvent mixtures (*i.e.*, without the use of a non-solvent). *See* Evidence Appendix 3; *see also Ex parte Parks*, 30 U.S.P.Q.2d at 1236 (finding negative limitation support in an example); MPEP § 2163.02 ("Possession may be shown in a variety of ways including description of an actual reduction to practice....").

In view of the above, it is clear that Appellant's specification provides written support for the phrase "and not with a non-solvent." Therefore, Appellant requests the Board to overturn the written description rejection of claims 18-34 under 35 U.S.C. § 112, first paragraph.

**2. A Brief Explanation of Why the Obviousness Rejection Is Improper**

The Examiner's subjective beliefs concerning Appellant's use of the phrase "and not with a non-solvent" appears to carry over into the obviousness rejection. For instance, the Examiner contends that "[w]hereas the prior art of Duchane et al which might only employ a solvent (as in the instant, allegedly) might not have perfectly smooth surfaces at this magnification, it is believed that one of ordinary skill in the art would understand from this disclosure that the surfaces treated with only a solvent would have macroscopically smooth surfaces. It is submitted that these macroscopically smooth surfaces would be the instant smooth surfaces." October 3, 2005 Office Action at page 3 (Evidence Appendix 4).

This statement is patently incorrect, supported by no evidence (either extrinsic or intrinsic), and contrary to the teachings in Duchane. It is undisputed that Duchane discloses that "it appears that a nonsolvent **is necessary** to achieve a super-smooth surface. The nonsolvent allows the controlled extract of the solvent from the substrate." Duchane at col. 8, lines 17-21 (Evidence Appendix 1) (emphasis added). A polished surfaced is not obtained in Duchane when a non-solvent is not used. Rather, a surface having a "wrinkled appearance" (*id.* at col. 2, lines 17-20) with "transverse ripples," "rounded pits," "lumps," "blistered appearance[s]," "circular imperfections," and "undulating surface[s] with numerous pits" (*Id.* at col. 8, lines 13-16; col. 8, lines 41-43; and col. 9, lines 1-6) is produced. If anything, Duchane clearly teaches away from using a solvent system that does not include a non-solvent—*i.e.*, it leads a person of ordinary skill in the art to use a combination of solvents **and** nonsolvents.

Duchane also teaches away from Appellant's claimed combination of a "grinding" step with "attacking the principal surface of the article with a solvent or a mixture of organic solvents." *See, e.g.*, Duchane at col. 1, lines 34-54 (Evidence Appendix 1) (explaining that mechanical grinding processes are "very expensive," require "special equipment," and are "difficult to produce super-smooth surface finishes."). In fact, Duchane actually compares a grinding process with its disclosed solvent/nonsolvent combination process **without** suggesting that the two processes could or should be combined. *Id.* at col. 3, lines 42-52.

Additionally, it seems readily apparent that if a person of ordinary skill in the art were to combine a grinding step with Duchane's solvent only disclosure (as suggested by the Examiner), one would expect to obtain a method that includes: (1) a machine grinding process that "invariably" produces a surface having "machining ridges" (*id.* at col. 1, lines 34-54); and (2) a solvent only system that produces surfaces having a "wrinkled appearance" (*id.* at col. 2, lines

17-20). Stated another way, there appears to be little if any expectation of obtaining a polished surface when the cited art is combined—much less a reasonable expectation of success of obtaining such a surface.

In view of the above, it is clear that the obviousness rejection is without merit. Therefore, Appellant requests the Board to overturn the obviousness rejection of claims 18-34 under 35 U.S.C. § 103.

### B. Substantial Evidence Is Required to Uphold the Examiner's Position

Findings of fact and conclusions of law by the U.S. Patent and Trademark Office must be made in accordance with the Administrative Procedure Act, 5 U.S.C. § 706(A), (E), 1994. *Dickinson v. Zurko*, 527 U.S. 150, 158 (1999). The Federal Circuit has held that findings of fact by the Board of Patent Appeals and Interferences must be supported by "substantial evidence" within the record. *In re Gartside*, 203 F.3d 1305, 1315 (Fed. Cir. 2000). In *In re Gartside*, the Federal Circuit stated that "the 'substantial evidence' standard asks whether a reasonable fact finder could have arrived at the agency's decision." *Id.* at 1312.

Accordingly, it necessarily follows that an Examiner's position on Appeal must be supported by "substantial evidence" within the record in order to be upheld by the Board of Patent Appeals and Interferences.

### C. Claims 18-34 Are Supported by the Specification and Therefore Comply with the Written Description Requirement

#### 1. A Summary of the Rejection

Claims 18-34 stand rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. The Examiner contends that there is no written support for the recitation in claim 18 of "not with a non-solvent." June 15, 2006 Final Office Action at page 2 (Evidence Appendix 2).

Appellant disagrees. Contrary to the Examiner's assertion, Appellant's specification supports this limitation and satisfies the written description requirement of 35 U.S.C. §112, first paragraph. A copy of Appellant's specification filed February 6, 2002 is attached as Evidence Appendix 3.

#### 2. An Objective Standard Is Used to Determine Compliance With the Written Description Requirement

The applicable patent laws, rules, and legal precedent make clear that a determination of whether a claim limitation complies with the written description requirement of 35 U.S.C. § 112, first paragraph, is premised on a specific objective legal standard. The *Manual of Patent Examining Procedure* (MPEP) explains this in the following way:

> An objective standard for determining compliance with the written description requirement is, "does the description clearly allow persons of ordinary skill in the art to recognize that he or she invented what is claimed." *In re Gosteli*, 872 F.2d 1008, 1012, 10 USPQ2d 1614, 1618 (Fed. Cir. 1989).

MPEP § 2163.02; *see also Ex parte Parks*, 30 U.S.P.Q.2d 1234, 1236 (Bd. App. 1993) ("In rejecting a claim under the first paragraph of 35 U.S.C. 112 for lack of adequate descriptive support, it is incumbent upon the examiner to establish that the originally-filed disclosure would not have reasonably conveyed to one having ordinary skill in the art that an appellant had

possession of the now claimed subject matter."). With respect to the use of negative limitations, the MPEP explains that "[i]f alternative elements are positively recited in the specification, they may be explicitly excluded in the claims." MPEP § 2173.05(i).

### 3. The Examiner Contradicts Settled Patent Law and Applies a Subjective Standard In Making the Written Description Rejection

Instead of following the above objective standard, the Examiner makes the following statement which is based on his own subjective belief:

> **While applicant admittedly has support for the mixture of solvents to contain a non-solvent** (page 5, lines 1-5), this would appear to be more an afterthought based on the disclosure of the admitted prior art (ie, page 2, lines 20-21 which in fact is the Duchane et al reference applied against the claims) rather than an alternate embodiment.

June 15, 2006 Final Office Action at page 2 (Evidence Appendix 2) (emphasis added). The Examiner continues his subjective analysis by stating:

> While there may be case law to allow alternative embodiments to be expressly excluded from the claims, it is respectfully submitted that the instant disclosure of using a non-solvent does not rise to the level of an alternative embodiment, at least one that would be excluded from the claims.

*Id.* at 3. The Examiner concludes by declaring that "[i]f [the claim language "not with a non-solvent"] were really an alternative embodiment, then certainly some example would have been disclosed using such an embodiment." *Id.*

In summary, the Examiner appears to suggest some hierarchy in which explicit statements in the specification may be: (1) afterthoughts; (2) alternative embodiments that may not be excluded from claims; or (3) alternative embodiments that may be excluded from claims. The suggested hierarchy finds no support in the MPEP, rules, or statutes. The only suggestion of any objective analysis in the Examiner's standard is his requirement of a working Example for alternative embodiments of a disclosed invention. Although a working Example can be used to satisfy the written description requirement, it is by no means the only way to satisfy this

requirement. MPEP § 2163.02 ("Possession may be shown in a **variety** of ways including description of an actual reduction to practice [Examples], **or** by showing the invention was 'ready for patenting' such as by the disclosure of drawings or structural chemical formulas that show that the inventions was complete, or by describing distinguishing identifying characteristics sufficient to show that the applicant was in possession of the claimed invention.") (emphasis added).

Contrary to the Examiner's subjective beliefs, and as discussed in the following sections, Appellant's specification provides clear and objective support for the claimed element "attacking the principal surface of the article with a solvent or a mixture of organic solvents and not with a non-solvent."

#### 4. Appellant's Specification Provides Written Support for the phrase "and not with a non-solvent"

The Examiner inappropriately applies his subjective standard to the following language which contemplates that "up to 20% by weight" of a non-solvent can be used in the context of the present invention:

> The solvent or mixture of solvents of the thermoplastic material to be treated **may** contain, in limited proportion, **up to 20% by weight**, preferably up to 15% by weight of an organic diluent which **is not a solvent** of the thermoplastic material to be treated. An example of such an organic diluent is ethylene glycol diacetate.

Specification at page 5, lines 1-4 (emphasis added) (Evidence Appendix 3).

A person of ordinary skill in the art, upon reading the above language, would reach at least the following two conclusions. First, the solvent or mixture of solvents "may" include a non-solvent. Stated another way, the use of the term "may" objectively confirms that the use of a non-solvent is a positive recitation of an alternative embodiment of the present invention. Therefore, Appellant has the right to disclaim this positively recited embodiment in the claims.

*See* MPEP § 2173.05(i) ("If alternative elements are positively recited in the specification, they may be explicitly excluded in the claims.").

Second, the phrase "up to 20% by weight" encompasses 0% up to 20% by weight of a non-solvent. *See, e.g., In re Mochel*, 470 F.2d at 640 ("As this Court has held, the phrase 'up to' of claim 2 includes zero as the lower limit."); *Ex parte Khusid*, 174 U.S.P.Q. 59 (explaining that "a moisture content of not more than 70% by weight" reads on dry material). Stated another way, a person of ordinary skill in the art would objectively reason that 0% of a non-solvent mean "and not with a non-solvent." *Ex parte Parks*, 30 U.S.P.Q.2d 1234, 1236 (Bd. App. 1993) (in reversing the examiner's written description rejection based on the negative limitation "in the absence of a catalyst," the Board explained "...it cannot be said that the originally-filed disclosure would not have conveyed to one having ordinary skill in the art that appellants had possession of the concept of conducting the decomposition step generating nitric acid in the absence of a catalyst.").

Consequently, Appellant's positive recitation of alternative embodiments comprising non-solvents allows Appellant to explicitly exclude non-solvents in the claims. *See* MPEP 2173.05(i).

**5. Additional Support for the Phrase "and not with a non-solvent" can be found in Other Language in the Specification—*i.e.*, "Pure Solvent"**

Appellant's specification explains that "pure" solvents or solvent mixtures can be used in non-limiting embodiments. For instance, the specification states:

> In the attack step, **the solvent or mixture of solvents is preferably pure, in other words it contains only the solvent or mixture of solvents** and during the attack on the surface of the article, in particular a polycarbonate article, only the thermoplastic material of the article is dissolved in this solvent or these solvents.

Specification at page 5, lines 5-9 (emphasis added) (Evidence Appendix 3). This passage confirms that in one aspect, the attacking step can be performed with "only the solvent or

mixture of solvents." MPEP § 2163.02 ("The subject matter of the claim need not be described literally (i.e., using the same terms or *in haec verba*) in order for the disclosure to satisfy the description requirement."). If the substance used in the attacking step contains only a solvent or mixture of solvents, then by definition it does not include a non-solvent. To conclude otherwise would defy logic, as well as basic tenets of the English language.

### 6. The Specification Provides Non-Limiting Working Examples That Use "Pure" Solvents or Solvent Mixtures

The Example on pages 12-14 of Appellant's specification confirms that optical articles (*e.g.*, lenses) can be polished by using pure solvent mixtures (*i.e.*, without the use of a non-solvent). *See* Evidence Appendix 3. For instance, "[c]onventionally ground, or ground and fine ground surfaces of polycarbonate lenses were subject to attacks according to the invention, under conditions detailed" in the "TABLE" on page 13 of the specification (Evidence Appendix 3). Column 7 of this TABLE identifies the types of solvents or solvent mixtures that were used. *Id.* Importantly, this TABLE illustrates that non-solvents were not used (*i.e.*, the TABLE confirms that solvent mixture contained **only** solvents and not non-solvents). Stated another way, the specification contains non-limiting exemplary data confirming that optical articles (*e.g.*, lenses) can be polished by "attacking the principal surface of the article with a solvent or a mixture of organic solvents and not with a non-solvent."

This is additional objective evidence that Appellant's specification supports the phrase "and not with a non-solvent." *See Ex parte Parks*, 30 U.S.P.Q.2d at 1236 (finding negative limitation support in an example); MPEP § 2163.02 ("Possession may be shown in a variety of ways including description of an actual reduction to practice...."). In order to reach any other conclusion, one would have to ignore the language and data contained within Appellant's specification, which would be contrary to settled U.S. patent law. *Ex parte Parks*, 30 U.S.P.Q.2d

at 1236 (explaining that the written description requirement is satisfied "if the originally-filed disclosure would have conveyed to one having ordinary skill in the art that an appellant had possession of the concept of what is claimed.").

#### 7. Conclusions on the Written Description Requirement

The prosecution record for this case is replete with objective evidence confirming that a person of ordinary skill in the art would recognize that Appellant had possession of the claimed element "attacking the principal surface of the article with a solvent or a mixture of organic solvents and not with a non-solvent." This objective evidence is present in many forms, including: (1) positive recitations of compositions that can include 0% up to 20% by weight of a non solvent; (2) language such as "pure" solvent which is described in the specification as containing "**only** the solvent or mixture of solvents"; and (3) non-limiting examples showing a reduction to practice of using solvents or solvent mixtures that do not include non-solvents.

This evidence confirms that the present written description rejection is without basis. It is clear that Appellant's specification provides written support for the phrase "and not with a non-solvent." Therefore, Appellant requests the Board to overturn the written description rejection of claims 18-34 under 35 U.S.C. § 112, first paragraph.

### D. Claims 18-34 Are Not Obvious Over "Admitted Prior Art" in View of Duchane

#### 1. A Summary of the Rejection

Claims 18-34 also stand rejected under 35 U.S.C. § 103(a) as being obvious "over the admitted prior art as set forth at page 1, line 7 through page 2, line 11 of the instant specification in view of Duchane *et al.* for the reasons of record." June 15, 2006 Final Office Action at page 3 (Evidence Appendix 2). Unfortunately, a complete summary of the current obviousness

rejection is not provided in the June 15, 2006 Action. Because of this, Appellant provides the following summary for the convenience of the Board:

The relevant portion of Appellant's specification (*i.e.*, "admitted prior art") relied upon by the Examiner as the primary reference states, in part:

> The main surfaces of an optical article are conventionally subjected to surface polishing.
>
> The surface polishing of an optical article comprises a group of operations leading to the production of an optical article, such as a lens whose surfaces are perfectly polished and have the desired curvatures (optical powers).
>
> Surface polishing typically comprises three successive steps: grinding, fine grinding, and polishing.
>
> Grinding is a mechanical process step using a coarse-grain diamond cutter or an insert cutter, intended to create the curvature on the surface of the optical article such as a lens or contact lens.
>
> Fine grinding is also a mechanical processing step, performed after the grinding, using a fine-grain diamond cutter or emory (or paper or carborundum). The surface of the optical article after this fine grinding has a matt appearance.
>
> The final operation of the surface polishing, which leads to a perfectly polished and transparent surface, is called polishing and again consists of a mechanical treatment using felt discs in contact with a fine abrasive suspension....
>
> Although a purely mechanical surface polishing such as that described above does enable the production of acceptable optical articles, either from inorganic or organic glass, it has several disadvantages....
>
> [The inventors] have now found that it is possible to surface polish an optical article made from transparent thermoplastic material by replacing one of the mechanical steps of fine grinding or polishing by a fine grinding and/or polishing step by attack using a solvent or a mixture of solvents.

Appellant's Specification at page 1, line 7, to page 2, line 29. The Examiner concedes that the "admitted prior art" fails to disclose "the final mechanical steps of the grinding—ie, the fine grinding and/or polishing—would be replaced with an attack of the principal surface of the article with a solvent or a mixture of solvents." October 6, 2004 Office Action at page 2 (Evidence Appendix 6).

Because of the deficiencies in the "admitted prior art," the examiner cites to Duchane *et al.* (Evidence Appendix 1) as the secondary reference and states that this reference "discloses obtaining super smooth plastic surfaces for optical articles including lenses by...attacking the plastic surface with a solvent." October 6, 2004 Office Action at page 2 (Evidence Appendix 6). The Examiner also alleges that Duchane *et al.* indicates "that the solvent treatment is to replace a diamond knife machining, such being disclosed in the admitted prior art as fine grinding...It clearly would have been obvious to one of ordinary skill in the art to replace either the fine grinding and/or the polishing of the admitted prior art with the solvent attack of Duchane for the very reason noted in Duchane and indeed by applicant—namely, to reduce costs due to equipment and to obtain an even smoother surface than would be attainable using mechanical means." *Id* at pages 2-3; *see also* April 25, 2005 Final Office Action at page 3 (Evidence Appendix 5) (The Examiner states "Duchane et al is merely being relied upon to teach the obviousness of replacing a mechanical polishing with a solvent-induced polishing, which the reference does indeed teach.").

**2. A Summary of Appellant's Arguments**

Appellant disagrees with the obviousness rejection. Claims 18-34 are not obvious over the cited art as a *prima facie* case of obviousness has not been established. MPEP § 2142 ("The examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness"). The following sections confirm that every element of Appellant's claimed invention is not disclosed by the combined cited art (*e.g.*, the combined cited art fails to disclose "and not with a non-solvent"). Additionally, a person of ordinary skill in the art would not be motivated to combine Appellant's "admitted prior art" in view of Duchane, especially given the fact that Duchane teaches away from: (1) combining its disclosure with the "admitted prior art"; and (2) Appellant's claimed invention. Finally, there is no reasonable expectation of success that

combining the cited art would work. Therefore, a *prima facie* case of obviousness is not present, and the present rejection should be overturned. *Id.*

### 3. The combination of Appellant's "Admitted Prior Art" with Duchane Fails to Disclose Every Element of the Present Invention

The cited art fails to disclose Appellant's claimed element of "[a] method of surface polishing...comprising...attacking the principal surface of the article with a solvent or a mixture of organic solvents and not with a non-solvent of the transparent thermoplastic material." Claim 18. In fact, the Examiner concedes that this element is not disclosed by the "admitted prior art." October 6, 2004, Office Action at page 2 (Evidence Appendix 6).

As for Duchane, the Examiner's subjective beliefs concerning Appellant's use of the phrase "and not with a non-solvent" appears to carry over into this obviousness rejection. For instance, the Examiner argues that "[w]hereas the prior art of Duchane et al which might only employ a solvent (as in the instant, allegedly) might not have perfectly smooth surfaces at this magnification, it is believed that one of ordinary skill in the art would understand from this disclosure that the surfaces treated with only a solvent would have macroscopically smooth surfaces. It is submitted that these macroscopically smooth surfaces would be the instant smooth surfaces." October 3, 2005 Office Action (Evidence Appendix 4).

The Examiner's statement is patently incorrect, supported by no evidence (either extrinsic or intrinsic)[1], and contrary to the teachings in Duchane. It is clear that Duchane concerns the production of "super-smooth" articles that are made of thermoplastic materials. Duchane at Abstract (Evidence Appendix 1). The polishing step appears to be directed to immersing the thermoplastic material into a bath "consisting essentially of" a solvent **and** a non-solvent. *Id.* at

[1] The Federal Circuit has held that findings of fact by the Board of Patent Appeals and Interferences must be supported by "substantial evidence" within the record. *In re Gartside*, 203 F.3d at 1315. Therefore, an Examiner's position on Appeal must be supported by "substantial evidence" within the record in order to be upheld by the Board of Patent Appeals and Interferences.

col. 3, lines 17-41 ("To achieve the foregoing and other objects, and in accordance with the purposes of the present invention, as embodied and broadly described herein, a method of producing at least one super-smooth surface on an article made of thermoplastic material...comprises: (a) immersing at least a portion of the article into a bath consisting essentially of (1) at least one solvent for the thermoplastic material, (2) at least one nonsolvent for the thermoplastic material...and (b) slowly removing the solvent from the bath by diluting the bath with the nonsolvent...."). Duchane at col. 3, lines 17-41.

It is also undisputed that Duchane discloses that "it appears that a nonsolvent **is necessary** to achieve a super-smooth surface. The nonsolvent allows the controlled extract of the solvent from the substrate." Duchane at col. 8, lines 17-21 (Evidence Appendix 1) (emphasis added); *see also id.* at col. 8, lines 31-34 (Comparing the results in Example 2, Example 4, and Example 5 (below), one can observe that the proper choice of solvent-nonsolvent system is **critical** to achieving supper-smooth surfaces.").

A polished surfaced is not obtained in Duchane when a non-solvent is not used. Rather, a surface having a "wrinkled appearance" (*id.* at col. 2, lines 17-20) with "transverse ripples," "rounded pits," "lumps," "blistered appearance[s]," "circular imperfections," and "undulating surface[s] with numerous pits" (*Id.* at col. 8, lines 13-16; col. 8, lines 41-43; and col. 9, lines 1-6) is produced. If anything, Duchane clearly teaches away from using a solvent system that does not include a non-solvent—*i.e.*, it discourages the path taken by Appellant (*i.e.*, "and not with a non-solvent") and instead leads a person of ordinary skill in the art down a different path of using a combination of solvents **and** nonsolvents. (The following section provides a detailed discussion confirming that Duchane teaches away from the claimed "and not with a non-solvent" limitation).

Further, Duchane indicates that "super-smooth" means a "surface quality wherein all defects are smaller than about 4 $(\mu m)^2$ in area." *Id.* at col. 2, lines 53-55. This reference is silent regarding the roughness as measured by a mean deviation of the roughness profile from the mean line (Ra).

In a non-limiting aspect, Appellant's claimed invention reduces the Ra value. As shown in the drawings, using the solvent attack of the claimed invention leads to low Ra values (*see, e.g.*., FIGS. 18, 20, 21, and 24). With these low Ra values, the surface could be described in certain aspects as microscopically super-smooth. A person of ordinary skill in the art cannot infer from Duchane that the so-called "super-smooth" surface would have Ra values as small as those described in the non-limiting sections of Appellant's specification. Consequently, the Examiner's statement that the Duchane "macroscopically smooth surfaces would be the instant smooth surfaces" is ungrounded.

Because the Examiner has failed to show that every element of Appellant's claimed invention is disclosed by the combination of the cited art, a *prima facie* case of obviousness has not been shown. Therefore, Appellant requests that the obviousness rejection be withdrawn for at least this reason.

#### 4. Duchane Teaches Away From Appellant's Claimed "and not with a non-solvent" limitation

The objective evidence of record overwhelming confirms that Duchane teaches away from Appellants claimed "not with a non-solvent" limitation. For instance, Duchane discloses the use of a solvent without a non-solvent **only** as a comparative example against its solvent/nonsolvent combination system. *See* Duchane at col. 8, line 7, to col. 9, line 6 (Evidence Appendix 1). Importantly, Duchane repeatedly disparages the use of a solvent only system and even goes as far as concluding that "it appears that a nonsovent is **necessary**." *Id.* at col. 8, lines

17-21 (underline added); *see also id.* at lines 31-34 ("...one can observe that the proper choice of solvent-nonsolvent system is critical to achieving super-smooth surfaces.").

In fact, when a solvent only system is used as disclosed in Duchane, it apparently produces surfaces that have "transverse ripples," "rounded pits," "lumps," "blistered appearance[s]," "circular imperfections," and "undulating surface[s] with numerous pits." *Id.* at col. 8, lines 13-16; col. 8, lines 41-43; and col. 9, lines 1-6. The following statements made in Duchane concern examples in which a non-solvent is **not** used:

- "It is believed that the surface under magnification of about 20-40X would take on a wrinkled appearance as was observed in Example 1, described below." [Duchane at col. 2, lines 17-20].
- "Microscopic examination of about 20-40X showed that surface scratches had been eliminated but that transverse ripples, rounded pits, and lumps were now present." [*Id.* at col. 8, lines 13-16].
- "Upon removal from the treatment chamber, the surface was clear and superficially smooth at first, but the surface gradually took on a blistered appearance as white, circular imperfections began to form on it." [*Id.* at col. 8, lines 39-43].
- "Under an optical microscope at 20-40X, the surface was found to be mottled with many small bubbles on or beneath the surface. Scanning electron microscopy (SEM) at 300X showed an undulating surface with numerous pits, as shown in FIG. 3." [*Id.* at col. 9, lines 1-6].

It cannot be disputed that Duchane teaches a person of ordinary skill in the art that the use of a non-solvent is "necessary." In addition, Duchane's description of surfaces where a non-solvent is not used (see above bullet points) clearly disparages using Appellant's claimed step of "attacking the principal surface of the article with a solvent or a mixture of organic solvents and **not with a non-solvent**." The only objective conclusion that can be drawn from Duchane is that the teachings of this reference would lead a person of ordinary skill in the art away from Appellant's claimed invention (*i.e.*, "and not with a non-solvent") and towards using a solvent/nonsolvent combination. This is the hallmark of teaching away. *In re Gurley*, 27 F.3d at 553 ("A reference may be said to teach away when a person of ordinary skill, upon reading the

reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.").

Assuming a *prima facie* case of obviousness has been established by the Examiner, which Appellant's do not concede (*see*, *e.g.*, above and below arguments), the fact that Duchane teaches away from at least one aspect of the claimed invention is sufficient to overcome a *prima facie* case. *In re Peterson*, 315 F.3d 1325, 1331 (Fed. Cir. 2003) ("[A]n applicant may rebut a *prima facie* case of obviousness by showing that the prior art teaches away from the claimed invention in any material respect.").

### 5. There Is No Motivation To Combine the "Admitted Prior Art" With Duchane

In order to sustain the Examiner's obviousness rejection, there must also be "substantial evidence" that shows the existence of a motivation to combine Appellant's "admitted prior art" with Duchane. MPEP § 2143.01. The evidence of record suggests the opposite; it suggests that there is no motivation to combine the cited art.

Appellant's claimed invention includes **a combination** of at least one mechanical step (*e.g.*, "grinding") with "attacking the principal surface of the article with a solvent or a mixture of organic solvents and not with a non-solvent of the transparent thermoplastic material." Claim 18 (Claims Appendix). There is no motivation to combine a mechanical grinding process with the solvent/non-solvent polishing step in Duchane. *In re Dembiczak*, 175 F.3d 994, 999 (Fed. Cir. 1999) ("Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references.").

### *a. There is no motivation to combine the "admitted prior art" mechanical grinding process with the solvent/non-solvent polishing step in Duchane*

As discussed above, Duchane appears to concern the production of "super-smooth" articles that are made of thermoplastic materials. Duchane at Abstract (Evidence Appendix 1). The polishing step appears to be directed to immersing the thermoplastic material into a bath "consisting essentially of" a solvent and a non-solvent. *Id.* at col. 3, lines 17-41. Importantly, there is no suggestion in Duchane to combine its solvent/non-solvent polishing method with a mechanical grinding process.[2] If anything, Duchane actually teaches away from such a combination. For instance, Duchane explains that mechanical grinding processes (*e.g.*, "diamond knife" grinding) are "very expensive," require "special equipment," and are "difficult to produce super-smooth surface finishes":

> Although very smooth flat surfaces of some amorphous materials can be produced by pouring the amorphous material when it is a fluid, the smoothest rounded or formed (as opposed to flat) surfaces of plastics with softening points too low to permit the type of polishing used for glassy materials which have been obtained in the prior art are mechanically machined surfaces obtained by using a diamond knife. However, producing such a surface is very expensive, the surfaces invariably have machining ridges (which can be viewed at 1600X) left by the tooling; and in order to produce small articles by such a method, special equipment would be required for holding the articles while they are being machined. Furthermore, it is difficult to produce super-smooth surface finishes on polymers by mechanical means because heat produced by frictional processes is dissipated much more slowly by plastics than by metals or glass, and the lower softening points of these materials often result in gumming and poor finish control, as disclosed in *Modern Plastics Encyclopedia*, pp. 533–536, S. Gross, Editor-in-Chief (McGraw-Hill, NY, 1974).

[2] The Examiner readily admits that "applicant's specification is not being relied upon for any motivation to combine" its disclosure with Duchane. April 25, 2005 Office Action at page 3 (Evidence Appendix 5). Therefore, the motivation to combine must come from Duchane "or in the knowledge generally available to one of ordinary skill in the art." MPEP § 2142. The record is simply devoid of any evidence showing that a person of ordinary skill in the art would be motivated to combine a grinding step with the Duchane solvent/non-solvent polishing step. Thus, the Examiner is left with the teachings of Duchane, which actually teach away from such a combination.

Duchane at col. 1, lines 34-54 (Evidence Appendix 1) (underlines added). In fact, Duchane actually compares a grinding process with its disclosed solvent/nonsolvent combination process **without** suggesting that the two processes could or should be combined:

> **In an especially preferred embodiment, the thermoplastic material is acrylic (i.e., poly(methyl methacrylate)), the solvent is acetone, and the nonsolvent is a particular mixture of water and a polyethylene glycol having a particular molecular weight. Using this combination, extremely smooth rounded or formed surfaces were obtained which had very few imperfections and no visible machining marks when viewed at a magnification of up to 1600× (unlike the smoothest prior art rounded or formed surfaces of thermoplastic material, which were obtained by diamond knife machining).**

*Id.* at col. 3, lines 42-52 (emphasis added); *see also* MPEP § 2143.01[III] ("The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination.") (underline in original).

The fact that Duchane characterizes machine grinding processes as "very expensive" processes which require "special equipment" and are "difficult to produce super-smooth surface finishes" would lead a person of ordinary skill in the art away from using such a process—*i.e.*, Duchane teaches away from combining the "admitted prior art" with its solvent/nonsolvent polishing step. *In re Gurley*, 27 F.3d at 553. This is overwhelming objective evidence of a lack of motivation to combine Appellant's "admitted prior art" with Duchane's solvent/nonsolvent combination polishing method. MPEP § 2145[X](D)(2) ("It is improper to combine references where the references teach away from their combination.").

Because there is no apparent motivation to combine the cited art, an element necessary to establish a *prima facie* case of obviousness is missing. Therefore the present obviousness rejection cannot be maintained and should be overturned.

### *b. Duchane teaches away from Appellant's claimed combination of a grinding step with "attacking the principal surface of the article with a solvent or a mixture of organic solvents and not with a non-solvent of the transparent thermoplastic material"*

Duchane also teaches away from Appellant's claimed combination of a mechanical grinding step with "attacking the principal surface of the article with a solvent or a mixture of organic solvents and not with a non-solvent of the transparent thermoplastic material." The arguments provided in the section above equally apply here and are incorporated by reference. Basically, a person of ordinary skill in the art, upon reading Duchane, would be led to polish an article with a solvent/nonsolvent combination polishing step **without** using a mechanical grinding step claimed by Appellant. *See, e.g.*, Duchane at col. 1, lines 34-54 (Evidence Appendix 1) (explaining that that mechanical grinding processes are "very expensive," require "special equipment," and are "difficult to produce super-smooth surface finishes.").

This is additional evidence that the present obviousness rejection is improper and should be overturned. *In re Peterson*, 315 F.3d at 1331.

### *c. Conclusions on the lack of a motivation to combine*

It is clear from the evidence of record, that there is no motivation to combine Appellant's "admitted prior art" with the Duchane for several reasons. First, Duchane actually teaches away from combining a grinding process with its solvent/nonsolvent combination. *See, e.g.*, Duchane at col. 1, lines 34-54 (Evidence Appendix 1) (explaining that that mechanical grinding processes are "very expensive," require "special equipment," and are "difficult to produce super-smooth surface finishes."); *see also* MPEP § 2145[X](D)(2) ("It is improper to combine references where the references teach away from their combination."). Second, Duchane teaches away from Appellant's claimed combination of a "grinding" step with "attacking the principal surface of the article with a solvent or a mixture of organic solvents." *Id.* Third, Duchane teaches away

from Appellant's claimed negative limitation "and not with a non-solvent." Duchane at col. 8, lines 17-21 (explaining that the use of a non-solvent is "necessary").

In view of the above, it is clear that there is no motivation to combine Appellant's "admitted prior art" with the teachings of Duchane. Therefore, a *prima facie* case of obviousness has not been established. Appellant requests the Board to overturn the obviousness rejection for at least this reason.

### 6. There Is No Reasonable Expectation of Success that Combining the "Admitted Prior Art" with Duchane Would Work

In order to sustain the Examiner's obviousness rejection, there must be "substantial evidence" that shows the existence of a reasonable expectation of success that the combination of a grinding step with the Duchane solvent/nonsolvent system would work. MPEP § 2143.02. The evidence of record suggests the opposite; it suggests that such a combination would not work.

First, it cannot be questioned that Duchane disparages using mechanical processes. In fact, Duchane explains that mechanical grinding processes (*e.g.*, "diamond knife" grinding) are "very expensive," require "special equipment," and are "difficult to produce super-smooth surface finishes." Duchane at col. 1, lines 34-54 (Evidence Appendix 1) (underlines added). This reference even explains that mechanical processes produce surfaces that have "imperfections" and "machining marks" (*id.* at col. 3, lines 48-52). Stated another way, Duchane discloses that mechanical grinding processes have inherent difficulties that limit the efficiency and effectiveness of their polishing capabilities. Second, Duchane also clearly teaches that the exclusion of a non-solvent produces surfaces that have "transverse ripples," "rounded pits," "lumps," "blistered appearance[s]," "circular imperfections," and "undulating surface[s] with numerous pits." *Id.* at col. 8, lines 13-16; col. 8, lines 41-43; and col. 9, lines 1-6.

In view of the teachings of Duchane, it seems readily apparent that if a person of ordinary skill in the art were to combine the "admitted prior art" with Duchane's solvent only disclosure (as suggested by the Examiner), one would expect to obtain a method that includes: (1) a machine grinding process that "invariably" produces a surface having "machining ridges" (*id.* at col. 1, lines 34-54); and (2) a solvent only system that produces surfaces having a "wrinkled appearance" (*id.* at col. 2, lines 17-20) with "transverse ripples," "rounded pits," "lumps," "blistered appearance[s]," "circular imperfections," and "undulating surface[s] with numerous pits" (*Id.* at col. 8, lines 13-16; col. 8, lines 41-43; and col. 9, lines 1-6). Stated another way, there appears to be little if any expectation of obtaining a polished surface when the cited art is combined—much less a reasonable expectation of success of obtaining such a surface. MPEP § 2143.02 (explaining that "at least some degree of predictability is required" to find a reasonable expectation of success of combining art references).

It is clear that there is no reasonable expectation of success to combine Appellant's "admitted prior art" with the teachings of Duchane. Therefore, a *prima facie* case of obviousness has not been established. Appellant requests the Board to overturn the obviousness rejection for at least this reason.

### 7. Dependent Claims 20-32 Are Separately Patentable

#### *a. Claim 20 is Separately Patentable*

Claim 20 is separately patentable. Dependent claim 20 is directed to "[a] method of surface polishing...wherein the attacking comprises centrifugation of the solvent or mixture of solvents on the principal surface of the article." Duchane and the "admitted prior art" do not appear to mention centrifugation of the solvent. In a previous communication, the Examiner stated that "Duchane keeps the solvent bath in motion and one of ordinary skill in this art would have found a centrifuging to be an obvious expedient over continuously circulating the bath, as

either would provide a constant replenishing of the necessary solvent on the article as its principal surface is being smoothed." January 2, 2004 Office Action, at page 3 (Evidence Appendix 7).

Contrary to the Examiner's assertion, one of ordinary skill in this art would not find centrifuging to be an obvious expedient over a continuously circulating bath. The two processes are quite distinct and do not provide similar effects. In one non-limiting example, Appellant's discussion of the centrifugation process notes: "After the solvent had been deposited, the article was rotated at a speed of 4000 r.p.m. for about 9 seconds, i.e. a total attack time of about 10 seconds. During the final 9 seconds, the excess solvent on the surface was ejected." Appellant's Specification, at p. 10, lines 2-4 (underline added). A continuously circulating bath would not eject excess solvent from a surface to be treated. Consequently, one of skill in the art would not find centrifuging to be an obvious expedient over a continuously circulating bath.

Therefore, the requirements for establishing a *prima facie* case of obvious are not met for these claims. If independent claim 18 falls, dependent claim 20 is separately patentable and not obvious over the "admitted prior art" in view of Duchane.

***b. Claim 21 is Separately Patentable***

Dependent claim 21 is directed to "[a] method of surface polishing...wherein the attacking is further defined as comprising a radial disposition of the solvent or mixture of solvents on the principal surface." Duchane and the "admitted prior art" do not appear to mention radial disposition. The Examiner noted in a previous communication that "Duchane keeps the solvent bath in motion" and utilizes a process of "continuously circulating the bath." January 2, 2004 Office Action, at page 3 (Evidence Appendix 7). Duchane teaches a continuously circulating bath, rather than radial disposition of the solvent or mixture of solvents. Because a continuously circulating bath would cover the entire principal surface, it would not be

obvious to substitute radial disposition for a continuously circulating bath. *See* Appellant's specification at page 4, lines 12-17 (Evidence Appendix 3).

Therefore, the requirements for establishing a *prima facie* case of obvious are not met for these claims. If independent claim 18 falls, dependent claim 21 is separately patentable and not obvious over the "admitted prior art" in view of Duchane.

### *c. Claim 22 is Separately Patentable*

Dependent claim 21 is directed to "[a] method of surface polishing...wherein the radial deposition takes place from the center to the edge of the article." Duchane and the "admitted prior art" do not appear to mention radial deposition or deposition taking place from the center to the edge of the article. Therefore it would not be obvious to substitute radial deposition from the center to the edge for a continuously circulating bath.

The requirements for establishing a *prima facie* case of obvious are not met for these claims. If independent claim 18 falls, dependent claim 22 is separately patentable and not obvious over the "admitted prior art" in view of Duchane.

### *d. Claims 23-26 are Separately Patentable*

Dependent claim 23 is directed to "[a] method of surface polishing...wherein the attacking is performed by contacting the principal surface with a vapor of the solvent or mixture of solvents." Duchane and the "admitted prior art" do not disclose polishing by attacking a surface with a vapor of a solvent or mixture of solvents.

In contrast, the collaborators in Duchane exposed an acrylic rod "to vapor from boiling acetone for about 5 minutes." Duchane, col. 8, lines 37-43 (Evidence Appendix 1). Instead of obtaining a polished surface, the collaborators obtained a surface that had "a blistered appearance as white, circular imperfections began to form on it." *Id.* It appears that the "blistered

appearance" was visible apparent without the use of a microscope (compare with Example 1 which indicates that "[m]icroscopic examination" was used).

Therefore, the requirements for establishing a *prima facie* case of obvious are not met for claim 23. If independent claim 18 falls, dependent claim 23 is separately patentable and not obvious over the "admitted prior art" in view of Duchane. Dependent claims 24, 25, and 26 depend directly or indirectly from claim 23 and are also therefore separately patentable.

***e. Claims 27 and 28 are Separately Patentable***

Dependent claim 27 is directed to "[a] method of surface polishing...wherein the attacking is performed by contacting the principal surface with a vapor of the solvent or mixture of solvents [and] the contacting of the principal surface...comprises saturation with the vapor of the solvent or mixture of solvents."

Duchane and the "admitted prior art" do not appear to mention contacting the principal surface comprises saturation with vapor of the solvent or mixture of solvents." Therefore, the requirements for establishing a *prima facie* case of obvious are not met for these claims. If independent claim 18 falls, dependent claim 27 is separately patentable and not obvious over the "admitted prior art" in view of Duchane. Dependent claim 28 depends directly from claim 27 and is also therefore separately patentable.

***f. Claim 29 is Separately Patentable***

Dependent claim 29 is directed to "[a] method of surface polishing...wherein attacking comprises attacking by centrifugation of the solvent or the mixture of organic solvents and an attacking with a vapor phase of the solvent or mixture of organic solvents." Duchane and the "admitted prior art" do not appear to mention "centrifugation of the solvent"—much less suggest combining such a technique with a "vapor phase" technique. In a previous communication, the Examiner stated that "Duchane keeps the solvent bath in motion and one of ordinary skill in this

art would have found a centrifuging to be an obvious expedient over continuously circulating the bath, as either would provide a constant replenishing of the necessary solvent on the article as its principal surface is being smoothed." January 2, 2004 Office Action, at page 3 (Evidence Appendix 7).

Contrary to the Examiner's assertion, one of ordinary skill in this art would not find centrifuging to be an obvious expedient over a continuously circulating bath. The two processes are quite distinct and do not provide similar effects. In one non-limiting example, Appellant's discussion of the centrifugation process notes: "After the solvent had been deposited, the article was rotated at a speed of 4000 r.p.m. for about 9 seconds, i.e. a total attack time of about 10 seconds. During the final 9 seconds, the excess solvent on the surface was ejected." Appellant's Specification, at p. 10, lines 2-4 (emphasis added). A continuously circulating bath would not eject excess solvent from a surface to be treated. Consequently, one of skill in the art would not find centrifuging to be an obvious expedient over a continuously circulating bath.

Therefore, the requirements for establishing a *prima facie* case of obvious are not met for these claims. If independent claim 18 falls, dependent claim 29 is separately patentable and not obvious over the "admitted prior art" in view of Duchane.

### *g. Claims 30 and 31 are Separately Patentable*

Dependent claim 30 is directed to "[a] method of surface polishing...wherein attacking comprises attacking by centrifugation of the solvent or the mixture of organic solvents occurs before attacking with a vapor phase of the solvent or mixture of organic solvents." Dependent claim 31 is directed to "[a] method of surface polishing...wherein attacking comprises attacking by centrifugation of the solvent or the mixture of organic solvents follows the attacking with a vapor phase of the solvent or mixture of organic solvents."

Duchane and the "admitted prior art" do not appear to mention attacking by centrifugation, much less suggesting whether such a step be performed before or following attacking a surface with a vapor phase. Therefore, the requirements for establishing a *prima facie* case of obvious are not met for these claims. If independent claim 18 falls, dependent claims 30 and 31 are separately patentable and not obvious over the "admitted prior art" in view of Duchane.

**E. Conclusion**

Appellant has provided arguments that overcome the pending written description and obviousness rejections. The Examiner's conclusion that the claims should be rejected is unwarranted. Therefore, Appellant respectfully requests that the Board overturn the Examiner's rejection of claims 18-34.

Respectfully submitted,

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Dated: March 15, 2007

## VIII. CLAIMS APPENDIX

18. A method of surface polishing of at least one principal surface of an optical article made from transparent thermoplastic material comprising the successive steps of:

grinding;

fine grinding; and

polishing;

wherein the fine grinding and/or the polishing comprises attacking the principal surface of the article with a solvent or a mixture of organic solvents and not with a non-solvent of the transparent thermoplastic material.

19. The method of claim 18, wherein polishing comprises attacking the principal surface of the article with a solvent or a mixture of organic solvents of the transparent thermoplastic material.

20. The method of claim 18, wherein the attacking comprises centrifugation of the solvent or mixture of solvents on the principal surface of the article.

21. The method of claim 20, wherein the attacking is further defined as comprising a radial disposition of the solvent or mixture of solvents on the principal surface.

22. The method of claim 21, wherein the radial deposition takes place from the center to the edge of the article.

23. The method of claim 18, wherein the attacking is performed by contacting the principal surface with a vapor of the solvent or mixture of solvents.

24. The method of claim 23, wherein the vapor is produced by heating the solvent or mixture of solvents.

25. The method of claim 24, wherein the solvent or mixture of solvents is heated to its boiling point.

26. The method of claim 25, wherein the optical article is heated to a temperature lower than the boiling point of the solvent or mixture of solvents.

27. The method of claim 23, wherein the contacting of the principal surface with the vapor of the solvent or mixture of solvents comprises saturation with the vapor of the solvent or mixture of solvents.

28. The method of claim 27, wherein the solvent vapor is at ambient temperature.

29. The method of claim 18, wherein attacking comprises both an attacking by centrifugation of the solvent or the mixture of organic solvents and an attacking with a vapor phase of the solvent or mixture of organic solvents.

30. The method of claim 29, wherein the attacking by centrifugation of the solvent or mixture of organic solvents occurs before the attacking with a vapor phase of the solvent or mixture of organic solvents.

31. The method of claim 29, wherein the attacking by centrifugation of the solvent or mixture of organic solvents follows the attacking with the vapor phase of the solvent or mixture of organic solvents.

32. The method of claim 18, wherein the solvent is selected from the group consisting of dichloromethane, the dichloroethanes, acetone, methyl ethyl ketone, trichloromethane, THF and dioxane.

33. The method of claim 18, wherein the transparent thermoplastic material is polycarbonate.

34. The method of claim 18, wherein the optical article is further defined as a spectacle lens.

## IX. EVIDENCE APPENDIX

1. U.S. Patent No. 4,376,751 to Duchane – Cited by the Examiner in the Office Actions of January 2, 2004 and October 3, 2005 and the Final Office Actions of October 6, 2004 and June 15, 2006.

2. June 15, 2006 Final Office Action from U.S. Application No. 10/068,232.

3. Appellant's Specification filed February 6, 2002.

4. October 3, 2005 Office Action from U.S. Application No. 10/068,232.

5. April 25, 2005 Final Office Action from U.S. Application No. 10/068,232.

6. October 6, 2004 Office Action from U.S. Application No. 10/068,232.

7. January 2, 2004 Office Action from U.S. Application No. 10/068,232.

## X. RELATED PROCEEDINGS APPENDIX

[NONE]

# EVIDENCE APPENDIX 1
## (U.S. Patent 4,376,751 to Duchane)

# United States Patent [19]

**Duchane**

[11] **4,376,751**

[45] **Mar. 15, 1983**


[54] **PRODUCTION OF SUPER-SMOOTH ARTICLES**


[75] Inventor: **David V. Duchane,** Los Alamos, N. Mex.

[73] Assignee: **The United States of America as represented by the Department of Energy,** Washington, D.C.



[21] Appl. No.: **268,425**

[22] Filed: **May 29, 1981**

[51] **Int. Cl.**[3] ..... **B29C 25/00**

[52] **U.S. Cl.** ..... **264/341;** 428/409

[58] **Field of Search** ..... 264/341; 428/409



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*Primary Examiner*—James H. Derrington

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[57] **ABSTRACT**

Super-smooth rounded or formed articles made of thermoplastic materials including various poly(methyl methacrylate) or acrylonitrile-butadiene-styrene copolymers are produced by immersing the articles into a bath, the composition of which is slowly changed with time. The starting composition of the bath is made up of at least one solvent for the polymer and a diluent made up of at least one nonsolvent for the polymer and optional materials which are soluble in the bath. The resulting extremely smooth articles are useful as mandrels for laser fusion and should be useful for a wide variety of other purposes, for example lenses.


**12 Claims, 6 Drawing Figures**

Fig. 1

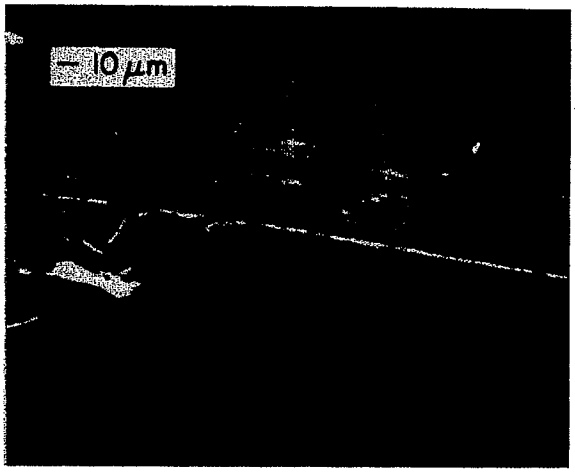


Fig. 2

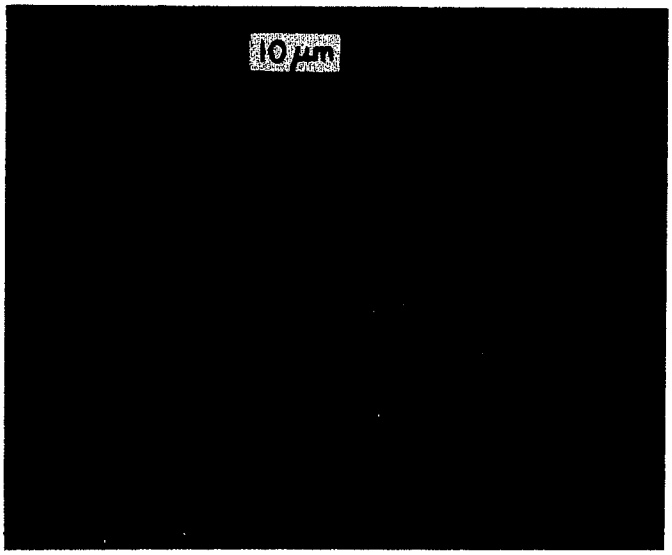


Fig. 3

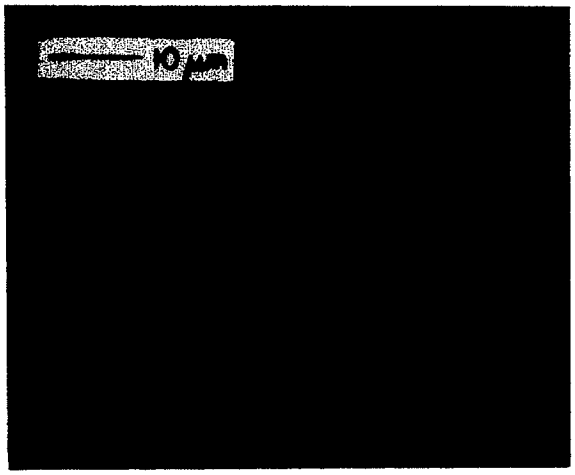

Fig. 4

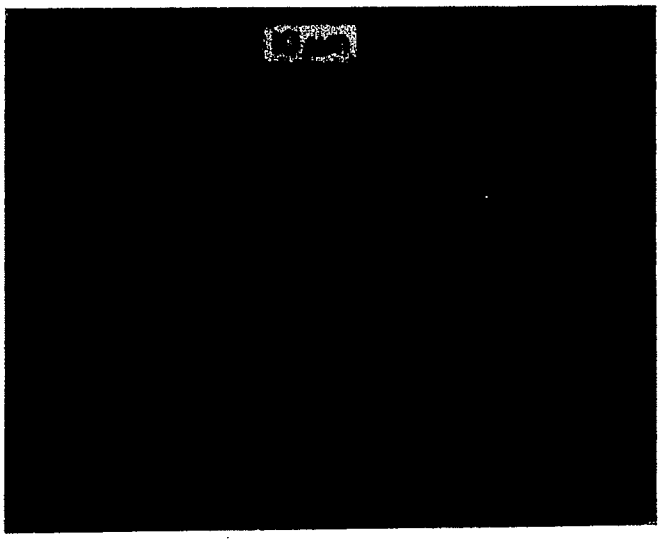

Fig. 5

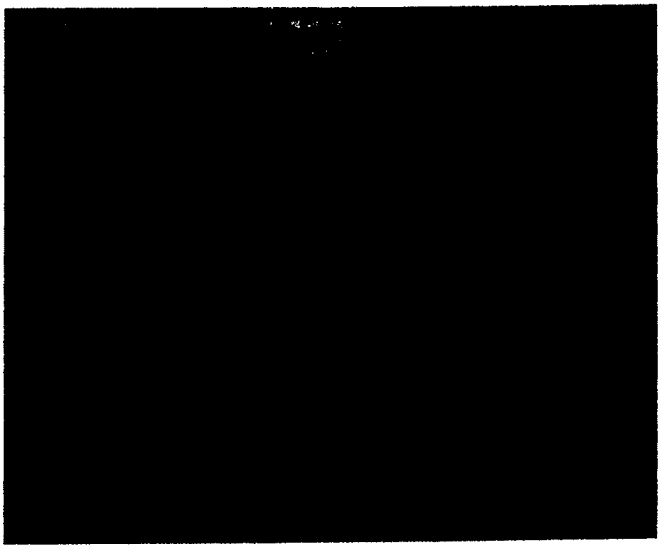

Fig. 6

# PRODUCTION OF SUPER-SMOOTH ARTICLES

## BACKGROUND OF THE INVENTION

This invention relates generally to a method of producing super-smooth articles made of thermoplastic materials and to the articles thus produced and relates more particularly to a method of producing super-smooth articles made of acrylic polymers or acrylonitrile-butadiene-styrene polymers. The invention is a result of a contract with the Department of Energy (Contract No. W-7405-ENG-36).

In the following, thermoplastic materials are defined to include linear and branched organic molecular structures that will repeatedly soften when heated and harden when cooled.

In the production of inertial confinement fusion (ICF) targets, mandrels with super-smooth surfaces are extremely important to the fabrication of metal confinement shells having the required degree of uniformity. To date, mandrels have been made almost exclusively from glass or metallic materials because it has not been considered practical to obtain plastic mandrels with the required degrees of surface smoothness and/or thermal stability. Metal is deposited onto the mandrel by a variety of techniques; and, any nonuniformity on the mandrel will appear on the target. Then, the mandrel is dissolved out, leaving a hollow metal confinement shell target. Using glass or metal presents severe difficulties when the mandrel is to be removed from the shell, however, since these materials tend to be soluble only in liquids which are difficult to handle (e.g., hydrofluoric acid) or which also attack the shell itself.

Although very smooth flat surfaces of some amorphous materials can be produced by pouring the amorphous material when it is a fluid, the smoothest rounded or formed (as opposed to flat) surfaces of plastics with softening points too low to permit the type of polishing used for glassy materials which have been obtained in the prior art are mechanically machined surfaces obtained by using a diamond knife. However, producing such a surface is very expensive, the surfaces invariably have machining ridges (which can be viewed at 1600X) left by the tooling; and in order to produce small articles by such a method, special equipment would be required for holding the articles while they are being machined. Furthermore, it is difficult to produce super-smooth surface finishes on polymers by mechanical means because heat produced by frictional processes is dissipated much more slowly by plastics than by metals or glass, and the lower softening points of these materials often result in gumming and poor finish control, as disclosed in *Modern Plastics Encyclopedia*, pp. 533–536, S. Gross, Editor-in-Chief (McGraw-Hill, NY, 1974).

In the past, solvent treatments of polymer surfaces have often involved the use of agents designed to make the polymer more receptive to inks and dyes, to increase the chemical reactivity of the polymer at its surface, or to impart other specialized properties to the material. These treatments generally involved the creation of a surface which was microscopically roughened, rather than smoothed.

In several Russian papers referenced in *Chemical Abstracts,* surface smoothing by solvent treatment was disclosed. The references include (1) V. L. Avramenko et al., "Improving the Strength Properties of Polymers by Removing Surface Defects," Fiz. Khim. Polim. Kompozitsii, 143–150 (1974) (Russ.), (2) A. A. Shturman et al., "Strengthening of Plastic Products in a Medium of Solvents for Polymers," Fiz.-Kihm. Mekh. Mater., 11(2), 78–83 (1975) (Russ.), and (3) A. A. Shturman et al., "Stabilization of Poly(Methyl Methacrylate)," Otkrytiya Izobret., Prom. Obraztsy, Tovarny Znaki (6), 86 (1979). In these references, an acrylic polymer (AST-T or poly(methyl methacrylate)) was subjected to a treatment at an elevated temperature of 80°–85° for 3–4 minutes. In reference (1), the acrylic polymer was immersed into amyl alcohol and butyl acetate; in reference (2), into amyl alcohol or butyl (or ethyl, methyl, propyl or isobutyl) acetate; and in reference (3), into a "stabilizer solution." The strength of the material improved and the surface was smoothed to some extent, although microscopic smoothing was not mentioned. It is believed that the surface under a magnification of about 20–40X would take on a wrinkled appearance as was observed in Example 1, described below.

In a fourth Russian reference listed in *Chemical Abstracts,* A. A. Shturman et al., "Surface Treatment by Solvents as a Method for Modification of the Properties of Polymeric Articles," Tezisy Dokl.—Resp. Konf. Vysokomol. Soedin., 3rd, 112–113 (1973) (Russ.), (the authors being two of the authors listed in the Russian references 1–3 above), the surfaces of molded plastic articles made of an acrylic polymer or acrylic resin were smoothed at an unspecified temperature by treatment with amyl alcohol or an acetate (methyl, ethyl, propyl, butyl, or isobutyl). Again, however, it is believed that the surface would most probably have taken on a wrinkled appearance (as in Example 1 below) and that no super-smooth surface would be achieved.

In U.S. Pat. No. 3,625,755 to Potrafke, coating with or impregnation by a metal-forming complex is disclosed. However, the process is not a smoothing process and where impregnation is carried out the material is impregnated throughout the entire structure, not just near the surface; and thus the method and articles produced are different from those of the present invention.

Some smoothing is obtained when one uses varnish remover, for example, to smooth scratches and surface imperfections. However, such smoothing does not produce a microscopically smooth surface which is necessary for producing laser fusion targets and which is desirable for other articles, for example lenses.

Therefore, despite what has been known in the prior art, a need has existed until now for a method of producing super-smooth rounded or formed surfaces made of thermoplastic material which are smoother than those obtained by diamond knife machining. By the term "super-smooth" is meant surface quality wherein all defects are smaller than about 4 $(\mu m)^2$ in area.

## SUMMARY OF THE INVENTION

An object of this invention is a method for producing super-smooth articles of manufacture made of certain thermoplastic materials and having rounded or formed surfaces.

Another object of this invention is a method of producing super-smooth articles made of poly(methyl methacrylate) or acrylonitrile-butadiene-styrene polymers.

A still further object of this invention is a super-smooth article of manufacture made of thermoplastic material and having rounded or formed surfaces.

Another object of this invention is a super-smooth mandrel made of poly(methyl methacrylate).

A further object of this invention is a super-smooth lens made of acrylic, the light transmission of the lens being enhanced by the absence of surface defects.

Yet another object of this invention is a super-smooth acrylic optical fiber having special properties.

Additional objects, advantages and novel features of the invention will be set forth in part in the description which follows, and in part will become apparent to those skilled in the art upon examination of the following or may be learned by practice of the invention. The objects and advantages of the invention may be realized and attained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

To achieve the foregoing and other objects, and in accordance with the purposes of the present invention, as embodied and broadly described herein, a method of producing at least one super-smooth surface on an article made of thermoplastic material which can be poly(methyl methacrylate) or an acrylonitrile-butadiene-styrene polymer or equivalents thereof comprises: (a) immersing at least a portion of the article into a bath consisting essentially of (1) at least one solvent for the thermoplastic material, (2) at least one nonsolvent for the thermoplastic material, and (3) optional accessory material which is soluble in the bath and which one may wish to deposit into the thermoplastic material; and (b) slowly removing the solvent from the bath by diluting the bath with the nonsolvent and the optional accessory material (both of which make up the diluent), the nonsolvent being a mixture of water and a water-soluble polymer having a molecular weight within the range from about 2000 to about 20,000, the solvent being selected from the group consisting of ketones and esters which show some significant mutual solubility with water, and the rate of dilution of the bath being such that it results in extraction of the solvent from the thermoplastic material on a molecular scale, rather than on a massive scale.

In an especially preferred embodiment, the thermoplastic material is acrylic (i.e., poly(methyl methacrylate)), the solvent is acetone, and the nonsolvent is a particular mixture of water and a polyethylene glycol having a particular molecular weight. Using this combination, extremely smooth rounded or formed surfaces were obtained which had very few imperfections and no visible machining marks when viewed at a magnification of up to 1600× (unlike the smoothest prior art rounded or formed surfaces of thermoplastic material, which were obtained by diamond knife machining).

It is believed that such super-smooth rounded or formed acrylic and acrylonitrile-butadiene-styrene copolymer surfaces have never before been obtained.

In the method of the invention, no elevated temperature need be used and thus bulk deformation of articles being smoothed is not a problem.

An unexpected result was observed upon using the method of the invention. When $CuBr_2$ was dissolved in the diluent (as described below in Example 6), the colored solution of $CuBr_2$ chemically infused into an acrylic rod so as to produce a uniformly dark annulus surrounding an inner region which appeared to have no infused $CuBr_2$. A sharp boundary between the two regions was observed. The uniformity and the sharp cutoff could not have been expected based upon classical concepts of fluid diffusion (as described for example in Daniels and Alberty, *Physical Chemistry*, 2nd Edition (Wiley and Sons, New York, 1963) p. 354). Therefore, it is believed that besides being useful for obtaining extremely smooth surfaces, the method of the invention can be used to implant simply, efficiently, and to a controlled depth a variety of substances into the thermoplastic material of which the surface is being smoothed. The infused material cannot be scratched off easily, as coatings can. Some applications of this implantation include the following. A catalyst can be deposited into the surface of the thermoplastic material and held in that position. This could be very useful if a foamed plastic having a very large surface area is the catalyst support and the catalyst is chemically infused by the method of the invention into the support. Another application of the smoothing method of the invention is to infuse an integral protective barrier into the smoothed surface of a thermoplastic material. Another application of the method is to produce an acrylic optical fiber into which a material is infused, producing two layers having different refractive indexes and having a very sharp boundary between the layers. Another application of the method of the invention is to infuse lead ions into an amorphous material, thus producing a radiation barrier on the amorphous material. Yet another application of this invention is to decorate thermoplastic materials.

The method of the invention can also be used to infuse volatile materials into the surface of a thermoplastic material. It has been noted that when acrylic was the thermoplastic material and when water was the infused material, the water was released very slowly from the acrylic. This release suggests, therefore, applications of the method of the invention for timed-release biological implants, for waste control and various industrial processes which would make use of such a release of an infused volatile compound in the thermoplastic material, for room deodorants, and for long-term bacteriocidal or pH control.

The applications described above make use of the method of the invention which (1) can produce an extremely smooth surface, (2) can allow implantation of a secondary substance into a polymer to a well-defined depth (thus allowing a modified surface layer to be built around a structurally sound core), and (3) allows infusing volatile materials into a thermoplastic material, from which the volatile materials will escape over periods of weeks to months.

## BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and form a part of the specification, illustrate embodiments of the present invention and, together with the description, serve to explain the principles of the invention. In the drawings are shown scanning electron micrographs (SEM's) which illustrate improvements in surface quality which result from using the method of the invention.

In FIG. **1**, the surface of an untreated commercially available poly(methyl methacrylate) rod is shown at a magnification of 300×.

In FIG. **2** is shown the surface of the same type of material that was shown in FIG. **1** after it had been subjected to diamond knife machining, this surface representing the best known prior art surface quality on a rounded or formed article made of thermoplastic material at a magnification of 1600×. The channels shown in the SEM are the machining marks. The length of the long line represents a distance of about 10 μm.

In FIG. 3 is shown a surface of poly(methyl methacrylate) obtained by using acetone as the solvent and only water as the nonsolvent, at a magnification of 300×. The surface appears to be undulating with numerous pits.

In FIG. 4, at a magnification of 1600× is shown a rounded poly(methyl methacrylate) surface which was obtained by the method of the invention, as described below. No machining marks are present, and significantly fewer and smaller surface imperfections exist than in FIG. 2. Here, the solvent was acetone and the nonsolvent was a mixture (described below) of water and polyethylene glycol.

In FIG. 5 is shown another surface at 1600× of poly(methyl methacrylate) obtained by using the method of the invention. Here, the solvent was acetone and the nonsolvent was a mixture (described below) of polyvinylpyrrolidone, water, and isopropyl alcohol. This surface has very few imperfections and has a spongy-like appearance.

In FIG. 6, using the same materials as in FIG. 5 but in a different ratio (as described below), an even more nearly uniform surface was obtained.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the practice of the method of the invention, the uniformity of the surface of a thermoplastic material is greatly improved by placing the material into a bath, through which a mixture (which varies with time) of materials is circulated over an extended period of time. The thermoplastic material should be a material which is capable of being softened and being penetrated by components of the bath without being dissolved in the bath.

The bath consists essentially of at least one solvent and at least one nonsolvent for the thermoplastic material, together with optional accessory material which is soluble in the bath and which one may wish to deposit into the amorphous material. It is believed that the use of the nonsolvent is critical to achieving the supersmooth surfaces; and this is demonstrated below in Examples 1 and 3.

The solvent should be at least one material selected from the group consisting of ketones and esters which show some significant mutual solubility with water, that group including acetone, methylethyl ketone, diethylketone, ethyl acetate, methyl acetate, isopropyl acetate, and methyl propionate.

The requirements of the initial solvent and nonsolvent system are (1) the solvent(s) and the nonsolvent(s) should be (or should be capable of being made) compatible with one another (i.e., so that they form a homogeneous solution) and (2) the system should be capable of softening and swelling, but not dissolving the polymer. If a smooth surface is to be obtained, the nature of the nonsolvent component must be such that it does not separate out into significant agglomerations, bubbles, or the like, either within the polymer matrix or at the surface of the polymer, as the treatment proceeds. The tendency for this separation to occur appears to be a function of the mobility of the nonsolvent and its inherent compatibility with the polymer material.

Examples of suitable systems include but are not limited to the following. Poly(methyl methacrylate) (i.e., acrylic) can be very effectively smoothed even at a microscopic level (as shown in FIG. 4 and described in Example 5) by placing the acrylic into a bath having acetone as the solvent material and having a mixture (as the nonsolvent component, which is used as the diluent) of polyethylene glycol (i.e., PEG) and water. Alternatively, another suitable system for improving the uniformity of a surface of acrylic is to use acetone as the solvent but to use as the diluent a mixture of water, polyvinylpyrrolidone, and a small amount of isopropyl alcohol (which improves the compatibility of water and acrylic). In this system, the resulting acrylic surface has a spongy-like appearance and is very smooth and uniform. (See FIGS. 5 and 6 and Example 7).

For other thermoplastic materials, the starting solution must consist of a bath consisting of a solvent (e.g., acetone for polystyrene and polycarbonate; cyclohexane for polymethylpentene) and a nonsolvent. The nonsolvent can consist of several components but as a whole it must be compatible enough with the polymer that it does not separate or agglomerate into occlusions greater than micron sized dimensions as the reaction proceeds. The nonsolvent should thus have polarity character somewhat similar to the polymer it is used with. A polymer with no strongly polar sites would require a nonsolvent component which also is generally nonpolar in nature. The solvent for the polymer must, of course, by nature of the solution process, have polarity characteristics similar to the polymer. For example, for a polymer such as poly(methyl methacrylate) a combination of water and PEG is a suitable nonsolvent component; however, a polymer like polymethylpentene which does not have highly polar sites may require a nonsolvent component consisting of an organic liquid such as acetone in combination with a fatty acid ester or wax such as beeswax.

Additives can be added to the starting solution of solvent and nonsolvent bath, provided that the additive(s) dissolve(s) in the starting solution. See Example 6 below. Examples of suitable additives which must be reasonably soluble in both the starting solution and end solution are metal salts (e.g., $CuBr_2$, $CuCl_2$, $Pb(NO_3)_2$; catalysts (e.g., $PdCl_2$, $AlCl_3$, and $FeCl_3$); volatile materials (e.g., calcium hypochlorite, iodine, and essential oils (e.g., oil of wintergreen, anise, and peppermint)); and organic materials (e.g., neutral red, phenol red, and nickel acetoacetate).

The total volume of starting solution is important only in that it should be sufficient to immerse the portion of the thermoplastic material which is to be smoothed by the method of the invention. However, the rate of dilution of the solvent (described below) is important and is related to the total bath volume. For example, if the total volume is reduced, the absolute rate of dilution must be reduced.

The starting ratio (by volume) of solvent to diluent should be generally selected so that attack on the amorphous material results, the attack being sufficient to soften but not dissolve the amorphous material. When the amorphous material is acrylic, when the solvent is acetone, and when the nonsolvent is a mixture of water and polyethylene glycol (PEG), the ratio of solvent:diluent (by volume) will generally be within the range from about 40:60 to about 80:20 and more preferably will be within the range from about 60:40 to about 80:20. This same general range is expected to be effective when the plastic treated is acrylonitrile-butadiene-styrene. (See Example 8, below.) The PEG should have a molecular weight within the range from about 2000 to about 15,000 for best smoothing. A more preferred range is about 3000 to about 6000 because low molecu-

lar weight varieties tend to form microscopic blotches on the treated surface and high molecular weight varieties lead to more rapid increases in viscosity of the nonsolvent (and thus a lower maximum pumpable concentration of the PEG). Best results were obtained for PEG-4000 (having an approximate molecular weight of 4000). Additionally, surface smoothing appears to improve as the amount of PEG relative to the amount of water is increased. The amount of PEG which can be incorporated in the nonsolvent is limited by the viscosity of the mixture because eventually a point is reached at which the solution is too thick to pump. Therefore, the weight ratio of water:PEG in the mixture of water and PEG should be within the range from about 75:25 to about 40:60 (by weight) for the molecular weight range described above and often will be about 50:50 (by weight) for the preferred PEG-4000.

When the amorphous material is acrylic, when the solvent is acetone, and when the diluent is a mixture of water, polyvinylpyrrolidone, and a small amount of isopropyl alcohol (less than about ½%), the starting volume ratio of solvent:diluent will generally be within the range from about 25:75 to about 65:35; and when the weight ratio of polyvinylpyrrolidone:water is about 50:50, the optimum starting volume ratio of acetone:diluent has been found to be about 50:50.

The final concentration of solvent:diluent at the end of the smoothing process should be essentially pure nonsolvent.

The length of time during which the article remains in the starting bath (before any additional diluent is added) should generally be as short as possible. Generally, it is desirable to have the method of the invention produce super-smooth surfaces in a minimum amount of time; and, therefore, the starting ratio of solvent:diluent and the rate of dilution will both be chosen to be relatively large and the dilution will be started as soon as possible after insertion of the article into the bath.

The rate of dilution will be limited to that which will result in extraction of the solvent from the polymer matrix on a molecular scale rather than on a massive scale.

The temperature of the bath can be elevated if desired but for convenience can be maintained at room temperature.

The flow rate through the bath must be slow enough to prevent shearing of the surface being smoothed.

The length of time during which diluent is added to the bath (i.e., approximately the total time of the object in the bath) is important to the degree of penetration of additives into the amorphous material and may be important to smoothing. It should generally be less than 24 hours (for convenience) and preferably will be 16–20 hours.

If small rounded or formed objects are to be smoothed, the bath can be in the shape of an upright funnel with the fluid inlet at the bottom of the funnel and fluid outlet(s) near the top. This would allow the objects to remain suspended in the bath in spite of changes in fluid density.

## EXAMPLES

The following examples illustrating various embodiments of the invention were carried out. In examples 1–7, the starting materials were cylindrical acrylic (poly(methyl methacrylate)) rods. In FIG. 1 is shown the untreated surface of one of these commercially available acrylic rods. In example 8, a cylindrical rod made of acrylonitrile-butadiene-styrene polymer obtained by injection molding and subsequent machining of resin from Borg-Warner Corporation and having the tradename Cycolac was used. In Example 9, a square-shaped acrylic rod was used.

### EXAMPLE 1 (CONTROL)

An acrylic rod was immersed in pure acetone for 5 minutes, then removed, and allowed to dry. Immediately after removel from the acetone, the surface of the rod appeared to be smooth. However, the surface became microscopically undulating as the acetone evaporated. Microscopic examination at about 20–40× showed that surface scratches had been eliminated but that transverse ripples, rounded pits, and lumps were now present.

From the results in Example 1 and Example 3 (below), it appears that a nonsolvent is necessary to achieve a super-smooth surface. The nonsolvent allows the controlled extraction of the solvent from the substrate.

### EXAMPLE 2 (CONTROL)

An acrylic rod was immersed in a stationary mixture of 75 v/o acetone and 25 v/o water for 15 minutes, then removed, and allowed to dry. The degree of surface rippling was greatly reduced as compared with Example 1, but imperfections which appeared to be due to water-spotting were scattered across the surface. The imperfections were in the form of irregular shaped indentations in the surface. Comparing the results in Example 2, Example 4 and Example 5 (below), one can observe that the proper choice of solvent-nonsolvent system is critical to achieving super-smooth surfaces.

### EXAMPLE 3 (CONTROL)

An acrylic rod was exposed to vapor from boiling acetone for about 5 minutes. The vapor temperature was approximately 57° C. Upon removal from the treatment chamber, the surface was clear and superficially smooth at first, but the surface gradually took on a blistered appearance as white, circular imperfections began to form on it.

### EXAMPLE 4

An acrylic rod ⅛ inch in diameter was immersed to a depth of about 8 inches in one arm of a U-tube containing a mixture of 75 v/o acetone and 25 v/o water, with a total volume of about 125 ml. The fluid was kept continuously circulating through the U-tube and past the acrylic rod at a rate of about 10 ml/minute by means of a circulating pump attached to the U-tube with flexible tubing. Dilution of the mixture with water was begun immediately after placing the tube in the bath. This was accomplished by placing a "T" in the circulating loop at a point just above the entry of the fluid into one arm of the U-tube and pumping diluent into the system with a peristaltic metering pump at a rate of about 0.4 ml/min. Circulation of the fluid served to promote rapid and uniform mixing of the diluent into the bath. An overflow tube, located on the arm of the U-tube opposite the diluent inlet, provided a means for maintaining constant bath volume. Using the conditions described here, the composition of the treatment bath was gradually changed from 75 v/o acetone:25 v/o water to about 99.5 v/o water over a period of about 20 hours. After approximately 20 hours in the treatment bath, the rod was removed, washed with water, allowed

to dry, and subsequently examined. Under an optical microscope at 20–40×, the surface was found to be mottled with many small bubbles on or beneath the surface. Scanning electron microscopy (SEM) at 300× showed an undulating surface with numerous pits, as shown in FIG. 3.

## EXAMPLE 5 (INVENTION)

The experiment described in Example 4 was repeated with the sole exception that where water had been used in the previous example, a mixture of 50 w/o water and 50 w/o polyethylene glycol-4000 (with a molecular weight of about 4000) was now used. Examination of the sample after treatment under an optical microscope at 140× showed a smooth, essentially defect-free surface. SEM's (one of which is shown in FIG. 4) at 1600×, likewise, showed a smooth surface with a complete absence of the undulations and pits found for the sample of Example 4. The area of the largest defect was about 4 $(\mu m)^2$ and the total number of all other defects (none of which had an area greater than 1 $(\mu m)^2$) in FIG. 4 is less than about 50 per 3000 $(\mu m)^2$. In FIG. 2, on the other hand, the area of the largest defect was about 16 $(\mu m)^2$ and the total number of defects (not even including machine marks) was greater than 70 per 3000 $(\mu m)^2$. It is believed that at least some of the defects in FIG. 4 are probably due to contamination from the atmosphere because the treated sample was left unprotected for several months. Additionally, the surface had no blotches. The surface shown in FIG. 4 is the smoothest surface which has been obtained with the bath system made of acetone, PEG, and water.

In a series of further runs, various other grades of PEG were used in conjunction with water as diluent materials. When the diluent was composed of 90 w/o water and 10 w/o PEG-1000, the undulatory surface features were somewhat reduced from those shown in FIG. 3. At 50 w/o water and 50 w/o PEG-1000, the undulations essentially disappeared but blotchy regions were scattered across the surface of the rod. Using a diluent of 50 w/o water and 50 w/o PEG-1540, the surface blotches were noticeably smaller but still numerous. Experiments conducted using low molecular weight (600) PEG and very high molecular weight (20,000) PEG additives gave totally unsatisfactory results. At both of these extremes, the modified surfaces had wrinkles which were apparent to the unaided eye.

## EXAMPLE 6 (INVENTION)

The experiment of Example 5 was repeated once again, but now using a combination of three parts by weight of water, three parts by weight of PEG-4000, and two parts by weight of $CuBr_2$ in place of the water used in Example 4. In this case, SEM photographs showed the surface of the rod to have generally a smoothness (as regards maximum defect size) as good as that of Example 5 above (although more defects were here present than in Example 5), but several other interesting observations were also made. A section taken from the rod revealed that the diluent, which in this example was colored a deep green, had penetrated about 1300 μm into the core of the rod (about 72% of the distance to its center), and that the limit of penetration was marked, not by a gradual diminution of the intensity of the colored species, but rather by a sharp interface which clearly separated the infused sector from the unaffected core of the material. The interface appeared to be sharp even when viewed at a magnification of 140×.

Weight measurements were made to determine the amount of material infused into the rods of examples 4, 5, and 6, described above. The following results were obtained:

TABLE 1

| Rod from Example | Time after Removal from Treatment Bath (hr.) | Weight/Weight Prior to Treatment |
|---|---|---|
| 4 | 0.3 | 1.059 |
| | 1.5 | 1.044 |
| | 26 | 1.033 |
| | 1080 | 1.023 |
| 5 | 0.3 | 1.101 |
| | 1.3 | 1.096 |
| | 19 | 1.082 |
| | 1080 | 1.052 |
| 6 | 0.5 | 1.143 |
| | 2.3 | 1.133 |

## EXAMPLE 7

In this example, the same basic procedure as described above in Example 4 was used. However, here polyvinylpyrrolidone (molecular weight 10,000) in water was used as the diluent. However, when these two materials were mixed, a flocky precipitate appeared. This was eliminated by adding drop-wise a small amount (less than ½ w/o) of isopropyl alcohol.

In example 7a, the results of which are shown in FIG. 5, the starting composition of the bath was 60 v/o acetone and 40 v/o diluent. The diluent was made up of 40 w/o polyvinylpyrrolidone-10,000, 60 w/o water and less than ½ w/o isopropyl alcohol. As can be seen in FIG. 5, the resulting surface is very uniform and smooth and has very few imperfections, even when viewed at a magnification of 1600×.

In example 7b, the results of which are shown in FIG. 6, the starting composition of the bath was 50 v/o acetone and 50 v/o diluent. The diluent was 50 w/o polyvinylpyrrolidone-10,000, 50 w/o water and less than ½ w/o isopropyl alcohol. The treated surface is even more nearly uniform than that of Example 7a.

## EXAMPLE 8

In this example, instead of an acrylic polymer rod, an acrylonitrile-butadiene-styrene rod was inserted into a bath of which the starting composition was 75 v/o acetone and 25 v/o diluent, where the diluent was 50 w/o PEG-4000 and 50 w/o water. In this example, however, the rate of addition of the diluent and the initial volume were varied from those described above. Here, the rate of addition of diluent was 0.1 ml/min. and the initial volume was 25 ml. However, all other conditions were as described above in Example 4. The resulting surface was very amorphous (i.e., glass-like and showing no structure) with a few flecks scattered throughout the material. The surface looked smooth except for the flecks. Under an optical microscope the surface looked smooth at a magnification of 140×. All machine marks had been obliterated, as viewed at this magnification, and the number of surface imperfections was greatly reduced by the process. SEM's have been obtained for this system. The SEM of the untreated surface showed large and regular furrow-like machining marks at 1000×, whereas the treated sample appeared smooth except for a few (about 10 per 9900 $\mu m^2$) plate-like, raised areas scattered across the surface. The

largest of these plates had an area of approximately 65 $(\mu m)^2$ and most of the others were less than ¼ of that size.

## EXAMPLE 9

The same basic procedure used in Example 6 was here used, except that the rod was square-shaped, rather than cylindrical, $CuCl_2$ was here used, and the starting solution was 60 v/o acetone and 40 v/o diluent (made up of 3 parts by weight of water, 3 parts by weight of PEG-4000 and 2 parts by weight of $CuCl_2$). Again a sharp boundary between the infused sector and the uninfused core was observed and it occurred at about 1/32 inch from the outer surface. This example demonstrates that the sharp boundary is not dependent upon a cylindrical-shaped substrate.

The foregoing description of preferred embodiments of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed, and obviously many modifications and variations are possible in light of the above teaching. The embodiments were chosen and described in order to best explain the principles of the invention and their practical application to thereby enable others skilled in the art to best utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto.

What is claimed is:

**1.** A method of smoothing the surface of an article comprising a first material selected from the group consisting of poly(methyl methacrylate) and acrylonitrile-butadiene-styrene polymers, said method comprising:

(a) immersing at least a portion of said article into a bath consisting essentially of (1) at least one solvent for said first material and (2) a diluent consisting essentially of at least one nonsolvent for said first material and optional accessory material which is soluble in said bath; and

(b) slowly removing said solvent from said bath by diluting said bath with said diluent, wherein said nonsolvent is a mixture of water and a water-soluble polymer having a molecular weight within the range from about 2000 to about 20,000, wherein said at least one solvent is selected from the group consisting of ketones and esters which show some significant mutual solubility with water, and wherein the rate of dilution of said bath is such that it results in extraction of said solvent from said first material on a molecular scale, rather than on a massive scale.

**2.** A method according to claim **1**, wherein said first material is poly(methyl methacrylate), wherein said solvent is acetone, and wherein said water-soluble polymer is polyethylene glycol.

**3.** A method according to claim **1**, wherein said polyethylene glycol has a molecular weight within the range from about 3000 to about 6000.

**4.** A method according to claim **3**, wherein the starting composition of said bath is a volume ratio of said solvent:diluent which is within the range from about 40:60 to about 80:20.

**5.** A method according to claim **4**, wherein the weight ratio of water:polyethylene glycol in said nonsolvent is within the range from about 75:25 to about 40:60.

**6.** A method according to claim **5**, wherein said polyethylene glycol has a molecular weight of about 4000, wherein said weight ratio of water:polyethylene glycol in said nonsolvent is about 50:50, and wherein the starting composition of said bath is a volume ratio of said acetone:said diluent which is about 75:25.

**7.** A method according to claim **1** wherein said water-soluble polymer is polyvinylpyrrolidone (having a molecular weight of about 10,000) and wherein said nonsolvent includes also a small amount of isopropyl alcohol.

**8.** A method according to claim **7** wherein the starting composition of said bath has a volume ratio of solvent: diluent which is within the range from about 25:75 to about 65:35.

**9.** A method according to claim **8**, wherein the weight ratio of polyvinylpyrrolidone:water is about 50:50 and wherein the starting composition of said bath is a volume ratio of solvent:diluent which is about 50:50.

**10.** A method according to claim **1** wherein said first material is an acrylonitrile-butadiene-styrene copolymer, wherein said solvent is acetone and wherein said water-soluble polymer is polyethylene glycol.

**11.** A method according to claim **10**, wherein the starting composition of said bath has a volume ratio of solvent:diluent within the range from about 40:60 to about 80:20.

**12.** A method according to claim **11**, wherein the starting composition of said bath has a volume ratio of acetone:diluent of 75:25 and wherein said diluent was 50 weight percent polyethylene glycol-4000 and 50 weight percent water.

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# EVIDENCE APPENDIX 2
## (June 15, 2006 Final Office Action)

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|---|---|
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| ART UNIT | PAPER NUMBER |
|---|---|
| 1732 | |

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Please find below and/or attached an Office communication concerning this application or proceeding.



2 mo due to Provoke Advisory Action 8/15/06. Initial deadline for Final OA 9/15/06. Final 12/15/06. Notice of Appeal due 9/15/06. Final 12/15/06

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/068,232 | PRIEUR-BLANC ET AL. | |
| | Examiner | Art Unit | |
| | Mathieu D. Vargot | 1732 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *03 April 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *18-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *18-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

1.Claims 18-34 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The claims are rejected for the same reasons as set forth in the previous action. While applicant admittedly has support for the mixture of solvents to contain a non-solvent (page 5, lines 1-5), this would appear to be more an afterthought based on the disclosure of the admitted prior art (ie, page 2, lines 20-21 which in fact is the Duchane et al reference applied against the claims) rather than an alternate embodiment. It is noted that such a disclosure occurs nowhere else in the specification and was clearly never considered to be an alternative embodiment, since there are no examples directed to this aspect nor any other mention other than purely in passing. Hence, it is not clear to what extent the case law mentioned by applicant is probative. It is respectfully submitted that such a disclosure does not give applicant the right to positively exclude non-solvents from the claims.

2.The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 18-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art as set forth at page 1, line 7 through page 2, line 11 of the instant

specification in view of Duchane et al (col. 1, lines 40-50; col. 2, lines 45-55) for reasons of record.

3.Applicant's arguments filed April 3, 2006 have been fully considered but they are not persuasive. Applicant's comments concerning the new matter are not persuasive and have been essentially addressed in paragraph 1, supra. While there may be case law to allow alternative embodiments to be expressly excluded from the claims, it is respectfully submitted that the instant disclosure of using a non-solvent does not rise to the level of an alternative embodiment, at least one that would be excluded from the claims. Clearly, the disclosure as a whole contemplates using non-solvents as an afterthought and not as an alternative embodiment. If such were really an alternative embodiment, then certainly some example would have been disclosed using such an embodiment. The issue of obviousness has already been addressed. Concerning centrifugation, see the office action dated January 2, 2004, lines 13-17 of page 3.

4.**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

5.Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mathieu D. Vargot whose telephone number is 571 272-1211. The examiner can normally be reached on Mon-Fri from 9 to 6.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Christina Johnson, can be reached on 571 272-1176. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

M. Vargot
June 10, 2006

M. Vargot

Mathieu D. Vargot
Primary Examiner
Art Unit 1732

6/10/06

# EVIDENCE APPENDIX 3
**(Appellant's Specification)**

**Method for surface polishing of an optical article using a solvent or a mixture of solvents.**

The present invention relates in general terms to a method for surface polishing of the surface of an optical article made from a transparent thermoplastic material.

The main surfaces of an optical article are conventionally subjected to surface polishing.

The surface polishing of an optical article comprises a group of operations leading to the production of an optical article, such as a lens whose surfaces are perfectly polished and have the desired curvatures (optical powers).

Surface polishing typically comprises three successive steps: grinding, fine grinding, and polishing.

Grinding is a mechanical processing step using a coarse-grain diamond cutter or an insert cutter, intended to create the curvature on the surface of the optical article such as a lens or contact lens.

Fine grinding is also a mechanical processing step, performed after the grinding, using a fine-grain diamond cutter or emery (or paper or carborundum). The surface of the optical article after this fine grinding has a matt appearance.

The final operation of the surface polishing, which leads to a perfectly polished and transparent surface, is called polishing and again consists of a mechanical treatment using felt discs in contact with a fine abrasive suspension.

The grinding, which as stated above has the principal object of conferring the desired curvature to at least one surface of the optical article such as a lens or a contact lens, is a step of short duration which leads to an opaque optical article whose ground surface shows waves, defects of large amplitude and low frequency, generally in the form of a spiral pattern, onto which are superimposed a roughness consisting of defects of small amplitude and high frequency.

The fine grinding further changes the geometry of the treated surface of the optical article but is essentially intended to remove the waves as far as possible.

This mechanical treatment step leads to a translucid (but not yet transparent) article whose polished surface still shows significant roughness.

Finally, the polishing, a relatively long mechanical processing step, which

does not change the geometry of the treated surface of the article, removes the remaining roughness as far as possible to give the final transparent optical article.

Although a purely mechanical surface polishing such as that described above does enable the production of acceptable optical articles, either from inorganic or organic glass, it has several disadvantages.

Firstly, it is a long process, due in particular to the polishing step. Practice has also shown that it is difficult to remove the waves of large amplitude and low frequency. Finally, the mechanical fine grinding and polishing steps are steps which require a substantial range of equipment and are thus relatively costly.

The French patent n° 2 439 072 discloses a method for polishing surfaces of plastic materials, such as polycarbonate, by spraying a solvent vapour onto the surface to be polished.

The patent US-3 933 518 discloses a method for refluidifying the surfaces of thermoplastic materials by treatment with solvent vapours in order to remove imperfections.

The patent US-4 376 751 discloses a method for producing a smooth surface on a thermoplastic article which consists of immersing the article in a bath containing at least one solvent of the thermoplastic material and a non-solvent of the thermoplastic material.

The object of the present invention is thus a method for surface polishing of one surface of an optical article made from thermoplastic material which is simple to use, rapid, and enables at least the surface roughness to be removed without deforming the geometry of the treated surface of the optical article.

We have now found that it is possible to surface polish an optical article made from transparent thermoplastic material by replacing one of the mechanical steps of fine grinding or polishing by a fine grinding and/or polishing step by attack using a solvent or a mixture of solvents.

According to the invention, the method of surface polishing of at least one principal surface of an optical article made from transparent thermoplastic material comprises a grinding step, a fine grinding step and a polishing step and is characterized by the fact that the fine grinding and/or polishing step consists of performing an attack on the surface by a solvent or a mixture of organic solvents of the transparent thermoplastic material of the optical article.

The attack step is preferably the polishing step of the surface polishing

method, in other words the step of removal of the roughness of the surface of the article.

After grinding, the roughness of the surface of the article is generally characterized by a mean deviation of the roughness profile from the mean line, Ra, of 0.1 to 0.9 μm, typically of 0.2 to 0.5 μm. The polishing step by attack according to the invention enables the Ra value to be reduced by a factor of 5 or more.

The attack step of the surface polishing method according to the invention may be implemented in several ways.

In a first embodiment, the attack on the surface of the article may be performed by placing the surface of the article in contact with the vapour phase of a solvent or mixture of solvents of the thermoplastic material of the article. The vapour phase of the solvent or mixture of solvents may be obtained by heating the solvent and be itself at a temperature greater than the ambient temperature, or without heating, by saturation in the vapour of the solvent or mixture of solvents, the vapour phase being thus at ambient temperature.

For this step of attack with a solvent or mixture of solvents in the vapour phase, with heating, it is recommended to use a relatively short treatment time, generally of 5 minutes or less, so as to avoid deforming the treated surface of the article.

During this attack by hot vapour, the optical article itself may be heated to a temperature higher than ambient temperature, but generally to less than the boiling point of the solvent or mixture of solvents. This thus avoids too great a condensation of the vapour on the surface during the attack.

In general, whatever the mode of attack, the attack must be relatively short and generally of 5 minutes or less. It has been observed, particularly for a polycarbonate article, that prolonged attack results in a tendency for the roughness to increase again.

However, the attack with a solvent or mixture of solvents in the vapour phase, at ambient temperature, such as saturation with solvent vapour, can withstand longer treatment times.

In a second embodiment of the attack step, the thermoplastic optical article is dipped in the solvent or mixture of solvents in the liquid state.

In a third, preferred embodiment of the attack step according to the invention, the contact of the solvent or mixture of solvents with the surface of the article is effected by centrifugation, for example by placing an appropriate

quantity of the solvent or mixture of solvents on the surface of a rotating optical article by means of an appropriate device. This embodiment of the method of the invention has the advantages of being rapid (several tens of seconds and generally of the order of 10 seconds), simple and allows the treatment to be automated.

In this centrifugal attack mode, the solvent or mixture of solvents may initially be deposited on the centre of the surface of the article to be treated in order to be spread over the whole surface by centrifugation. However, the solvent or mixture of solvents is preferably deposited radially with respect to the surface of the article to be treated while the article is rotated by the centrifugation device.

More precisely, the radial deposit consists, while the article is in rotation, in depositing the solvent or mixture of solvents along a radius with respect to the rotation axis.

Although this radial deposit of the solvent or mixture of solvents may be effected either from the centre or from the edge of the article, the radial deposit from the centre towards the edge is preferred for better uniformity of the attack.

It is obviously possible to combine the different embodiments of the attack step of the method of the invention. A step of attack by centrifugation may in particular be combined with an attack in the vapour phase. In this case, it is preferable to perform a first attack in the vapour phase, then follow it with an attack by centrifugation.

The method of surface polishing of the invention may be applied to any ophthalmic article in transparent thermoplastic material conventionally used in the field concerned.

These thermoplastic materials include the polycarbonates, the poly(meth)acrylates, the polythio(meth)acrylates and their mixtures. The preferred thermoplastic materials are the polycarbonates, for example bisphenol A polycarbonate.

The solvent or mixture of solvents suitable for the method of the invention may be any solvent or mixture of solvents of the thermoplastic material to be treated.

The preferred solvents, in particular for the polycarbonate optical articles, include dichloromethane ($CH_2Cl_2$), trichloromethane ($CHCl_3$), the dichloroethanes such as 1,2-dichloroethane, acetone, methyl ethyl ketone, tetrahydrofuran (THF), dioxane and their mixtures.

The solvent or mixture of solvents of the thermoplastic material to be treated may contain, in limited proportion, up to 20% by weight, preferably up to 15% by weight of an organic diluent which is not a solvent of the thermoplastic material to be treated. An example of such an organic diluent is ethylene glycol diacetate.

In the attack step, the solvent or mixture of solvents is preferably pure, in other words it contains only the solvent or mixture of solvents and during the attack on the surface of the article, in particular a polycarbonate article, only the thermoplastic material of the article is dissolved in this solvent or these solvents.

In general, at the end of the attack step according to the invention, the solvent or solvents are evaporated so that at the end of this step, the optical article is recovered in its final state or ready for a subsequent treatment, without it being necessary to implement an additional step of removal of the solvent or solvents.

The method of the present invention is illustrated by the following examples and the annexed figures which respectively represent :

Figure 1 - a graph representing the profile of waves and roughness of the principal surface of a polycarbonate optical article subjected only to a conventional mechanical grinding;

Figure 2 - a graph representing the profile of waves and roughness of the principal surface of the optical article of figure 1 after an attack step according to the invention by centrifugation with dichloromethane as attack solvent;

Figure 3 - a graph representing the profile of waves and roughness of the principal surface of a polycarbonate optical article subjected only to a conventional mechanical grinding;

Figure 4 - a graph representing the profile of waves and roughness of the principal surface of the optical article of figure 3 after an attack step according to the invention by centrifugation with 1,2-dichloromethane as attack solvent;

Figure 5 - a graph representing the profile of waves and roughness of the principal surface of a polycarbonate optical article subjected only to a conventional mechanical grinding;

Figure 6 - a graph representing the profile of waves and roughness of the principal surface of the optical article of figure 7 after an attack step according to the invention by centrifugation with THF as attack solvent;

Figure 7 - a graph representing the profile of waves and roughness of the principal surface of a polycarbonate optical article subjected to conventional

grinding and fine grinding steps;

Figure 8 - a graph representing the profile of waves and roughness of the principal surface of the optical article of figure 7 after an attack according to the invention by centrifugation with dichloromethane as solvent;

Figure 9 - a graph representing the profile of waves and roughness of the principal surface of a polycarbonate optical article after conventional mechanical grinding and fine grinding;

Figure 10 - a graph representing the profile of waves and roughness of the principal surface of the article of figure 9 after an attack step according to the invention by centrifugation with 1,2-dichloromethane as attack solvent;

Figure 11 - a graph representing the profile of waves and roughness of the principal surface of a polycarbonate article after conventional mechanical grinding and fine grinding;

Figure 12 - a graph representing the profile of waves and roughness of the principal surface of the article of figure 11 after an attack step according to the invention by centrifugation with THF as solvent;

Figure 13 - a graph representing the profile of waves and roughness of the principal surface of a polycarbonate optical article after a simple conventional mechanical grinding;

Figure 14 - a graph representing the profile of waves and roughness of the principal surface of the article of figure 13 after an attack step in the vapour phase according to the invention for 1 minute 30 seconds with dichloromethane as solvent;

Figure 15 - a graph representing the profile of waves and roughness of the principal surface of a polycarbonate optical article after a simple conventional mechanical grinding step;

Figure 16 - a graph representing the profile of waves and roughness of the principal surface of the article of figure 15 after an attack step in the vapour phase according to the invention for 5 minutes with dichloromethane as solvent;

Figure 17 - a graph representing the profile of waves and roughness of the principal surface of a polycarbonate optical article after a simple conventional mechanical grinding step;

Figure 18 - a graph representing the profile of waves and roughness of the principal surface of the optical article of figure 17 after an attack step in the vapour phase for 10 minutes;

Figure 19 - a graph representing the profile of waves and roughness of

the principal surface of a polycarbonate optical article after conventional mechanical grinding and fine grinding;

Figure 20 - a graph representing the profile of waves and roughness of the principal surface of the article of figure 19 after an attack step in the vapour phase for 1 minute 30 seconds with dichloromethane as solvent;

Figure 21 - a graph representing the profile of waves and roughness of the principal surface of a polycarbonate optical article after conventional grinding;

Figure 22 - a graph representing the profile of waves and roughness of the principal surface of the article of figure 20 after an attack step in the vapour phase for 1 minute 30 seconds with a 50/50 mixture of chloroform and 1,2-dichloromethane with heating followed by an attack step by centrifugation with dichloromethane;

Figure 23 - a graph representing the profile of waves and roughness of the principal surface of a polycarbonate optical article;

Figure 24 - a graph representing the profile of waves and roughness of the principal surface of the optical article of figure 23 after an attack step in the vapour phase with heating according to the invention with a 50/50 mixture of 1,2-dichloroethane/dichloromethane as solvent.

In the present description and in particular in the following examples, the terms and expressions below have the meanings :

- Roughness : defects of low amplitude and high frequency appearing on the surface of the optical article after grinding. These defects are generally characterized by a value Ra, the mean of the deviations of the profile of the defects with respect to the mean line, of from 0.1 to 0.9 µm, typically 0.2 to 0.5 µm.

- Waves : Defects of high amplitude and low frequency appearing on the surface of the optical article after grinding, and onto which the roughness is superimposed.

The polycarbonate optical articles used in the examples below were semi-finished polycarbonate discs, marketed by the GENTEX Company, with diameter 80 mm and thickness 10 to 20 mm.

The conventional mechanical grinding of a principal surface of the articles comprised machining the surface of the disc with an insert cutter to

remove from 4 to 15 mm of the material of the articles and generate a spherical or toric shape. The grinding took from 20 seconds to 1 minute according to the surface state desired.

The conventional mechanical fine grinding of a principal surface of the articles comprised machining the ground surface of the article using an ORMAREX or LOH polisher with a shaping tool onto which was glued an abrasive silicon carbide polishing pad. The fine grinding time was 2 minutes 30 seconds per article.

The graphs of roughness profile and shape were obtained using an FTS device from the RANK-TAYLOR-HOBSON Company. Profilometry and roughness measurement by laser interferometry.

**Principle**

The FTS nondestructively measured the geometric properties of a section of the surface of the lenses in the polished or unpolished state.

This surface measurement was performed in a selected plane section.

A two-dimensional profile was thus obtained, represented by the equation : $Z = f(x)$.

The FTS was thus mainly used for the revolution lenses.

The shape, wave and roughness characteristics could be extracted from this profile.

The measurements could be used to monitor the surface state at each stage of the lens production (machining, fine grinding, polishing).

**Method**

The stylus moved on the surface of the article in its profilimetric plane.

The stylus used was a diamond point of radius 2 µm.

It recorded the heights Z of the surface as a functions of its displacement x. This gave the graph $Z = f(x)$.

The profile was compared to an ideal sphere, in other words a sphere for which the deviations of the profile compared to this sphere were minimum.

The characteristics of the deviations of shape compared to the geometric elements could be extracted from this graph.

The characteristics of the profile in terms of waves and roughness could also be obtained.

All the results were calculated by computer, the parameters and filters

being in accordance with international standards, including the characteristics of the Gaussian filter and the choice of bandwidth used to evaluate the data.

**Some definitions**

Filter : it deletes the components of long wavelength from the signal of the profile. Such a filter is called "low-pass".

**Comments on the graphs**

**Roughness graphs :**

The measurement was made over 10 mm with a roughness sensor (diamond point with radius 2 µm) and began 10 mm from the centre.

The results given (e.g. Ra = 0.02 µm) correspond to a roughness measurement performed with a Gaussian filter and a cut-off length of 0.08 µm. This filtered out the wave defect, thus leaving only the roughness defect. The graph corresponding to this measurement should be a straight line, since the surface waves are filtered out.

The graphs attached to the present description correspond to a reprocessing of the preceding measurement except that no filter was used. It is thus possible to display the roughness and wave defects.

Centrifugation attack

The surface to be treated of each article was measured before treatment for roughness and in some cases shape.

The surface of the article to be treated was first cleaned with isopropanol (manual rubbing) to remove residual dust from the surface.

The article was then placed on the axis of the centrifugation device where it was maintained by suction.

Once the article had reached a rotation speed of 4000 r.p.m., the solvent was dynamically deposited on the surface of the article in a rapid movement from the centre towards the edge (C to E), so as to cover the whole of the surface. This deposition of solvent took about 1 second. This dynamic deposition (radial deposition) gave a homogeneous distribution of the solvent

over the surface of the article.

After the solvent had been deposited, the article was rotated at a speed of 4000 r.p.m. for about 9 seconds, i.e. a total attack time of about 10 seconds. During the final 9 seconds, the excess solvent on the surface was ejected. The solvent which had penetrated into the polycarbonate network evaporated.

The rotation was then stopped (about 3 seconds required to bring to a complete halt) and the article was recovered.

At this stage, the treated surface of the article was dry and the article could be handled.

The surface of the article was then examined visually, by reflection under fluorescent light against a black background, or under an arc lamp.

The roughness of the surface and its shape were measured using the same apparatus.

Attack by saturated solvent vapour

The surface to be treated of each article was measured before treatment for roughness and shape.

The equipment used comprised a glass vessel, hermetic to air. This vessel was composed of two parts : a recipient and a cover maintained by silicone grease.

Half-way up the vessel recipient was a metal grille resting on the walls of the recipient. This grille was pierced by uniformly distributed small holes.

The solvent was placed in the recipient under the grille. The height of the solvent was about 5 cm. The solvent was stirred magnetically to give even distribution of the vapour. After about 10 minutes, the vessel was saturated with vapour.

Once the vessel was saturated in solvent vapour, the article was placed on the grille with the surface to be treated facing downwards (convex surface towards the top of the vessel, concave surface towards the bottom in the case of a lens whose back surface was to be treated).

The vessel was closed. The solvent was gently stirred to avoid any direct splashing onto the article. The article/vapour contact time was measured from the time that the vessel was closed. The contact time could be varied according to the final surface state desired.

Once the contact time was complete, the vessel was opened and the

article withdrawn. The article was left in air for a few minutes so that the remaining solvent could evaporate slowly. The article could then be handled.

The treated surfaces of the articles were then measured for roughness and shape.

Attack with hot solvent vapour

The surface to be treated of each article was measured before treatment for roughness and shape. The measurement instrument used was a shape sensor which could be displaced on the surface. The graph after analysis gave a topographical evaluation of the initial surface.

All the articles were placed in an oven at 60°C (for about 15 minutes) before treatment with the vapour. This avoided too great a condensation of the vapours on the surface when the article was placed in the vessel.

The equipment used comprised a glass vessel, hermetic to air.

This vessel was composed of two parts : a recipient and a cover maintained by silicone grease.

Half-way up the vessel recipient was a metal grille resting on the walls of the recipient.

This grille was pierced by uniformly distributed small holes.

The solvent was placed in the recipient under the grille. The height of the solvent was about 5 cm.

The solvent was stirred magnetically and heated to reflux using a thermal gun. The heating was stopped once the reflux was established.

The vessel was then ready to receive the sample

Once the solvent reflux was well established, the article to be polished was placed on the grille. It was noted that the polishing process was more even when the article was placed with the convex surface facing downwards, concave surface facing upwards. The surface to be polished was thus not directly in contact with the rising vapours.

This arrangement was more practical for handling the sample and led to less deformation of the surface to be polished.

The vessel was closed. The solvent was gently stirred to avoid any direct splashing onto the article.

The article/vapour contact time was measured from the time that the vessel was closed. This contact time could be varied according to the final

surface state desired.

(When the vapours were hot, the surface polishing process was accelerated. The contact times were thus shorter than when the article was treated with cold vapour).

The contact time with the hot solvent was thus from 30 seconds to 90 seconds for a ground surface and from 10 seconds to 60 seconds for a fine ground surface.

When the contact time was complete, the vessel was opened and the article withdrawn. This was placed in air for a few minutes on a mat so that the solvent which had penetrated into the network could evaporate slowly. The article could then be handled.

The surface of the article after treatment could be observed by reflection under fluorescent light against a black background.

In the case of transparent surfaces, the articles could be observed under an arc lamp.

Each treated article was measured for roughness and shape using the same instrument as before the treatment.

The effect of the vapours and the contact time could be characterized by a comparative analysis of the FTS graphs before and after treatment.

The hot vapours condensed on the surface immediately the article was placed in the vessel. A solvent film was formed directly in contact with the surface to be polished.

This method, as above for the cold vapours, reduced the amplitude of the waves, but also simultaneously gave a major reduction in roughness ($0.01\ \mu m < Ra < 0.03\ \mu m$).

The surfaces obtained were thus transparent.

## EXAMPLES

Conventionally ground, or ground and fine ground surfaces of polycarbonate lenses were subjected to attacks according to the invention, under conditions detailed in the table below.

The Ra values were measured and roughness graphs were established for the lens surfaces before and after chemical attack. The results are given in the table below.

**TABLE**

| Example | Initial state of surface treated | | Attack | | | Solvent | Ra | |
|---|---|---|---|---|---|---|---|---|
| | Ground | Fine ground | Centrifugation | Saturated vapour (attack time in s) | Hot vapour (attack time in s) | | Before attack | After attack |
| 1 | X | - | C to E | - | - | $CH_2Cl_2$ | 0.32 | 0.02 |
| 2 | X | - | C to E | - | - | $ClCH_2CH_2Cl$ | 0.35 | 0.06 |
| 3 | X | - | C to E | - | - | THF | 0.27 | 0.06 |
| 4 | X | X | C to E | - | - | $CH_2Cl_2$ | 0.31 | 0.01 |
| 5 | X | X | C to E | - | - | $ClCH_2CH_2Cl$ | 0.24 | 0.05 |
| 6 | X | X | C to E | - | - | THF | 0.24 | 0.05 |
| 7 | X | X | - | 1.5 | - | $CH_2Cl_2$ | 0.29 | 0.05 |
| 8 | X | X | - | 5 | - | $CH_2Cl_2$ | 0.3 | 0.07 |
| 9 | X | X | - | 10 | - | $CH_2Cl_2$ | 0.36 | 0.09 |
| 10 | X | X | X | 1.5 | - | $CH_2Cl_2$ | 0.22 | 0.05 |
| 11 | X | - | X | - | 90 | $CHCl_3/CH_2Cl_2$ (50/50) | 0.39 | 0.04 |
| 12 | X | - | - | - | 60 | $ClCH_2CH_2Cl$/ $CH_2Cl_2$ (50/50) | 0.47 | 0.02 |

Figures 1 to 12 are graphs representing the roughness of the surfaces of the articles of examples 1 to 6 before and after attack by centrifugation with different solvents.

These graphs show a significant reduction in roughness both for the surfaces which are ground only and for the ground and fine ground surfaces.

Figures 13 to 20 are graphs representing the roughness profile of the surfaces of the articles of the lenses of the examples 7 to 10 before and after attack according to the invention. These graphs show a significant reduction in roughness after the attack both for the surfaces which are ground only and for the ground and fine ground surfaces. However, figures 14, 16 and 18 show that increasing the attack time by the vapour to 5 minutes and more led to a slight

increase of the roughness.

Figures 21 and 22 are graphs representing the roughness profile of the lenses of example 11 before and after attack first by centrifugation, then by hot vapour.

Figures 23 and 24 are graphs representing the roughness profile of the lenses of example 12 before and after attack by hot vapour.

## CLAIMS

1. Method of surface polishing of at least one principal surface of an optical article made from transparent thermoplastic material comprising a grinding step, a fine grinding step and a polishing step, characterized in that the fine grinding and/or polishing step consists of an attack on the principal surface of the article by a solvent or a mixture of organic solvents of the transparent thermoplastic material.

2. Method characterized in that the attack constitutes the polishing step.

3. Method according to claim 1 or 2, characterized in that the attack is performed by centrifugation of the solvent or mixture of solvents on the principal surface of the article.

4. Method according to claim 3, characterized in that the solvent or mixture of solvents is deposited on the principal surface following a radial deposition.

5. Method according to claim 4, characterized in that the radial deposition takes place from the centre to the edge of the article.

6. Method according to claim 1 or 2, characterized in that the attack is performed by placing the principal surface in contact with the vapour of a solvent or mixture of solvents.

7. Method according to claim 6, characterized in that the vapour is produced by heating the solvent or mixture of solvents.

8. Method according to claim 7, characterized in that the solvent or mixture of solvents is heated to its boiling point.

9. Method according to claim 6, characterized in that the contact of the principal surface with the vapour of the solvent or mixture of solvents is performed by saturation with the vapour of the solvent or mixture of solvents.

10. Method according to claim 9, characterized in that the solvent vapour is at ambient temperature.

11. Method according to claim 1 or 2, characterized in that the attack step comprises an attack by centrifugation and an attack in the vapour phase.

12. Method according to claim 11, characterised in that the attack by centrifugation precedes the attack in the vapour phase.

13. Method according to claim 11, characterised in that the attack by centrifugation follows the attack in the vapour phase.

14. Method according to claim 8, characterized in that the optical article

is heated to a temperature lower than the boiling point of the solvent or mixture of solvents.

15. Method according to any of the preceding claims. characterized in that the solvent is selected from dichloromethane, the dichloroethanes, acetone, methyl ethyl ketone, trichloromethane, THF and dioxane.

16. Method according to any of the preceding claims. characterized in that the transparent thermoplastic material is polycarbonate.

17. Method according to any of the preceding claims. characterized in that the optical article is a spectacle lens.

FIG.1

AVANT

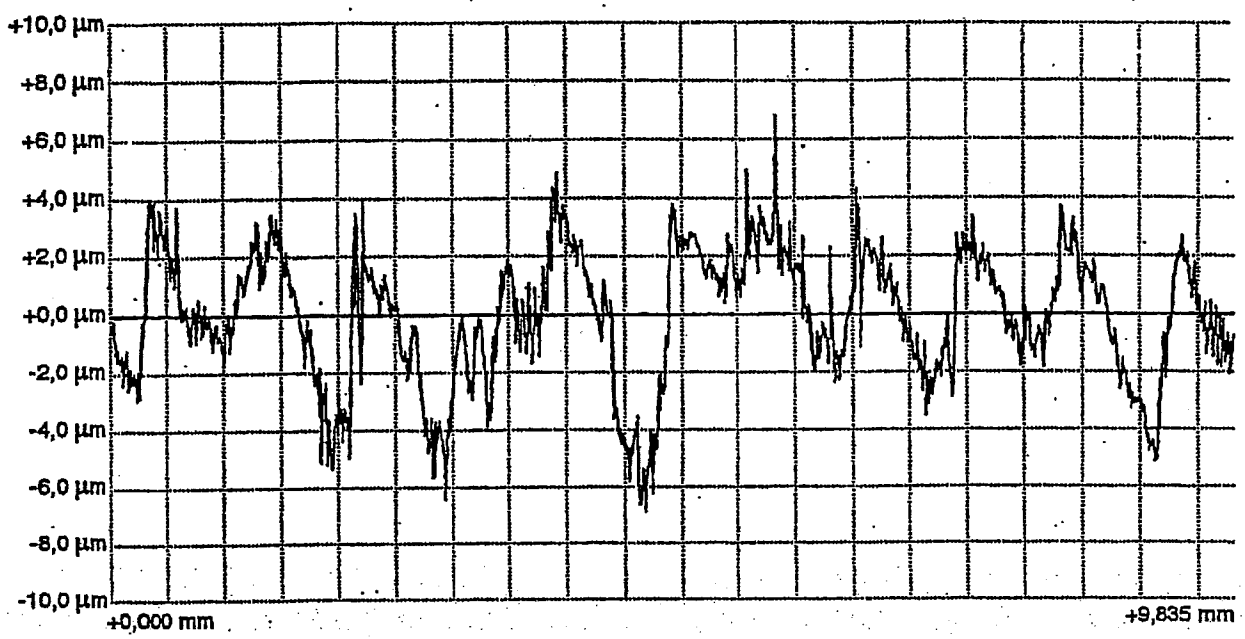



FIG.2

APRES

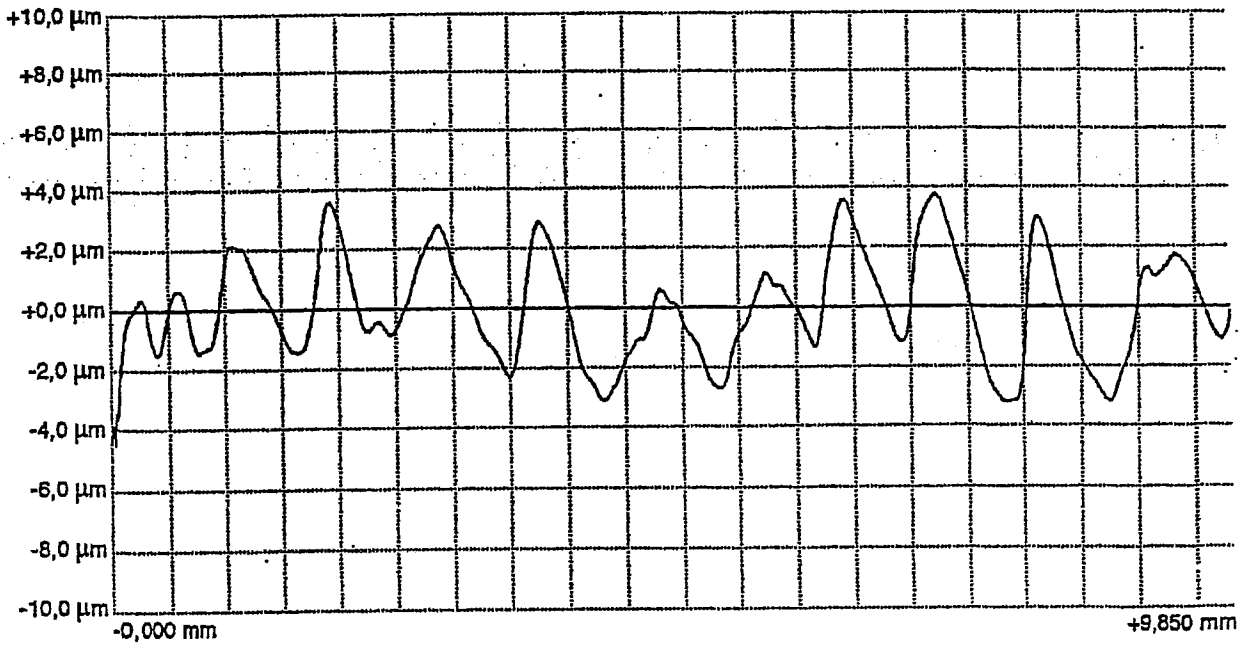
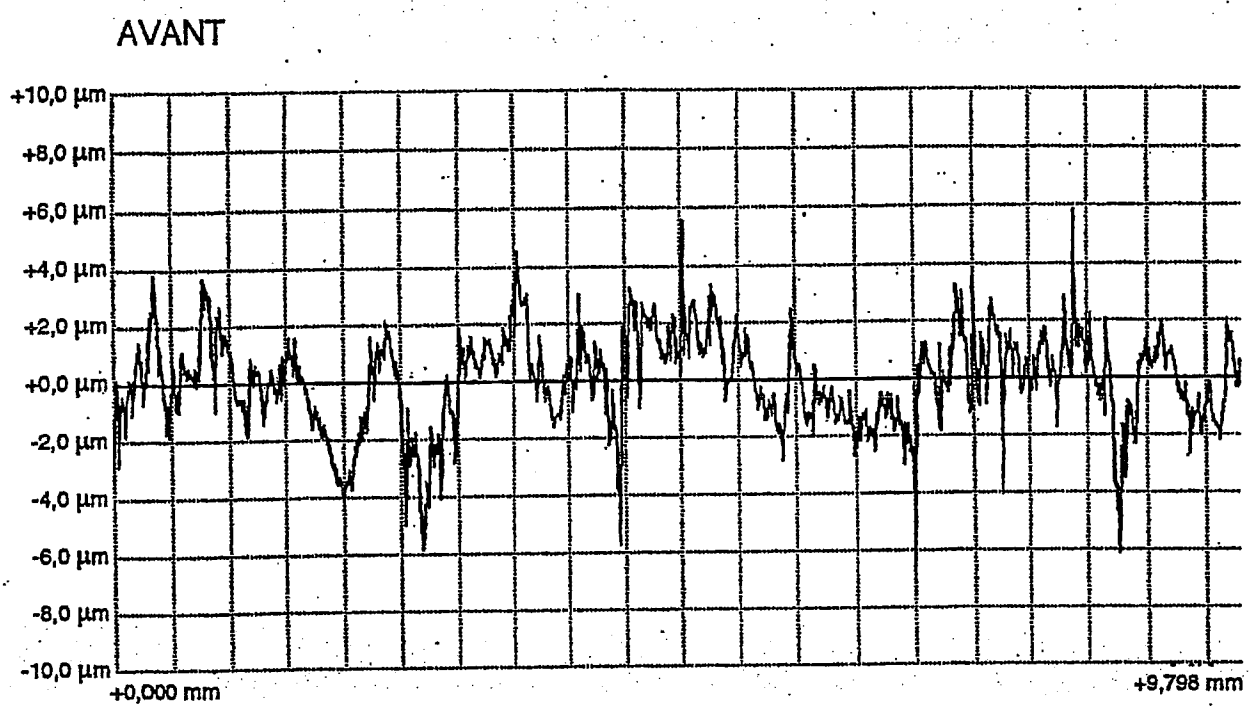


FIG.3


AVANT
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+8,0 µm
+6,0 µm
+4,0 µm
+2,0 µm
+0,0 µm
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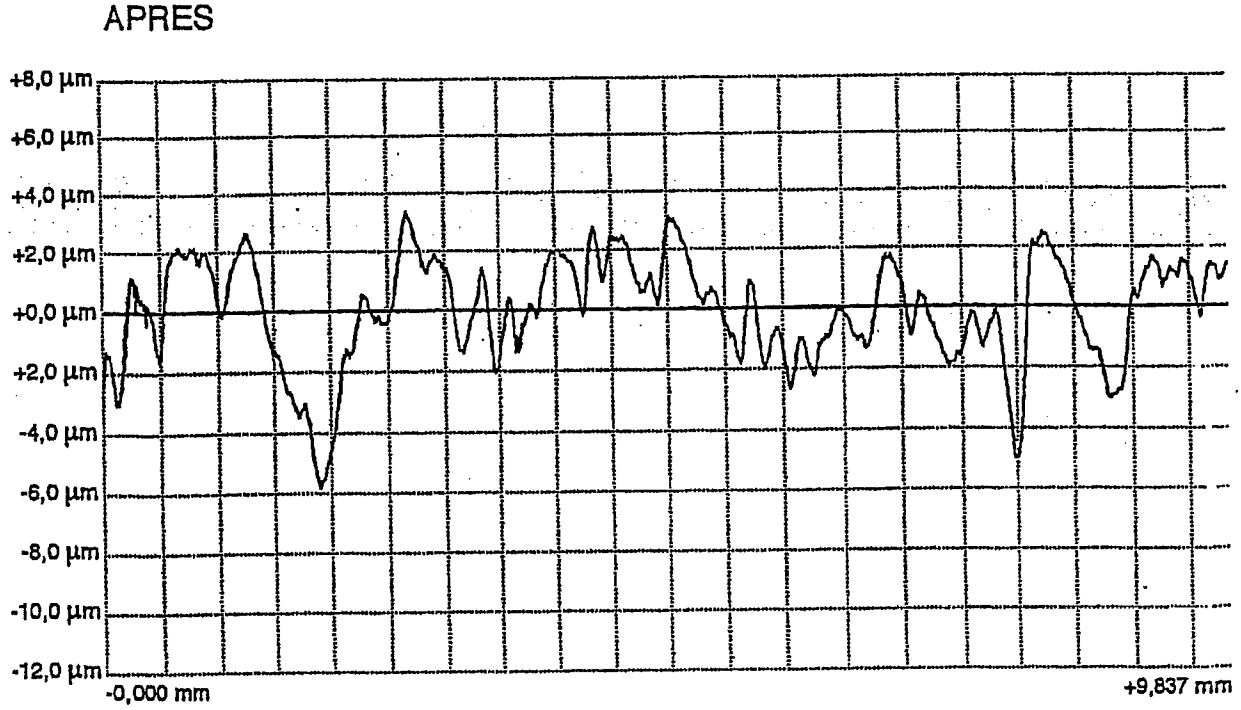
-4,0 µm
-6,0 µm
-8,0 µm
-10,0 µm
+0,000 mm
+9,798 mm

FIG.4


APRES
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+6,0 µm
+4,0 µm
+2,0 µm
+0,0 µm
+2,0 µm
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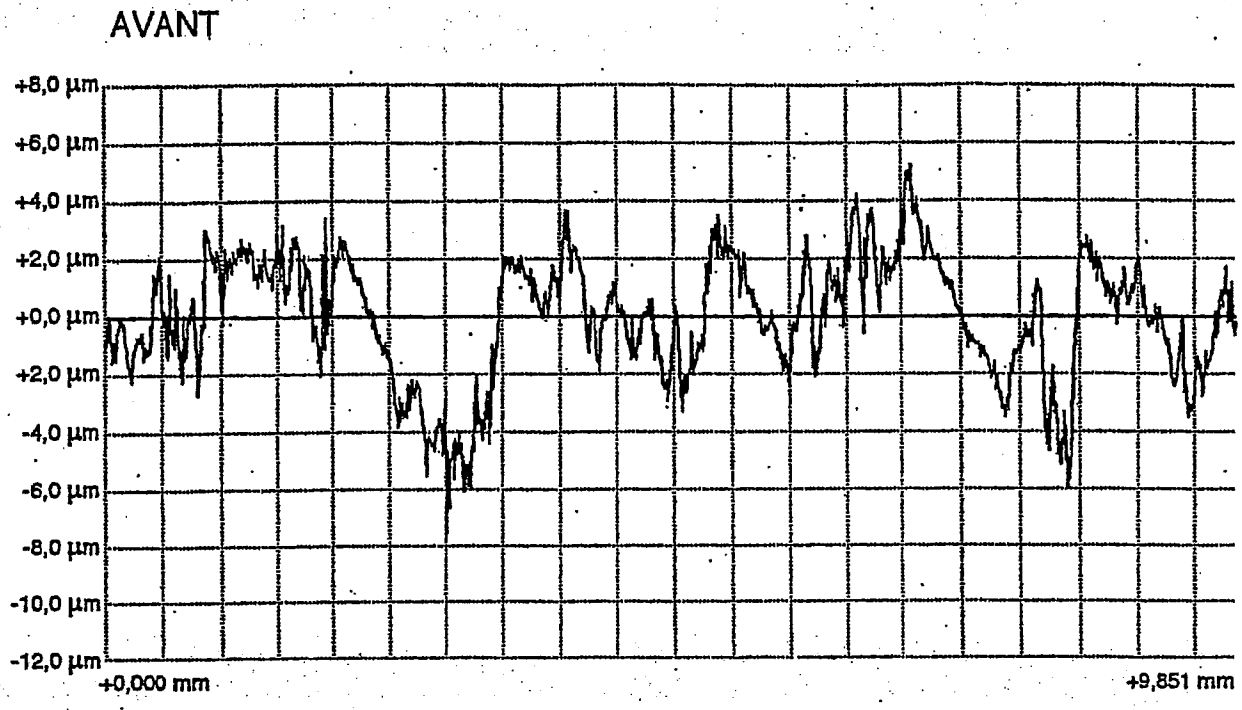
-6,0 µm
-8,0 µm
-10,0 µm
-12,0 µm
-0,000 mm
+9,837 mm

FIG.5


AVANT
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+6,0 µm
+4,0 µm
+2,0 µm
+0,0 µm
-2,0 µm
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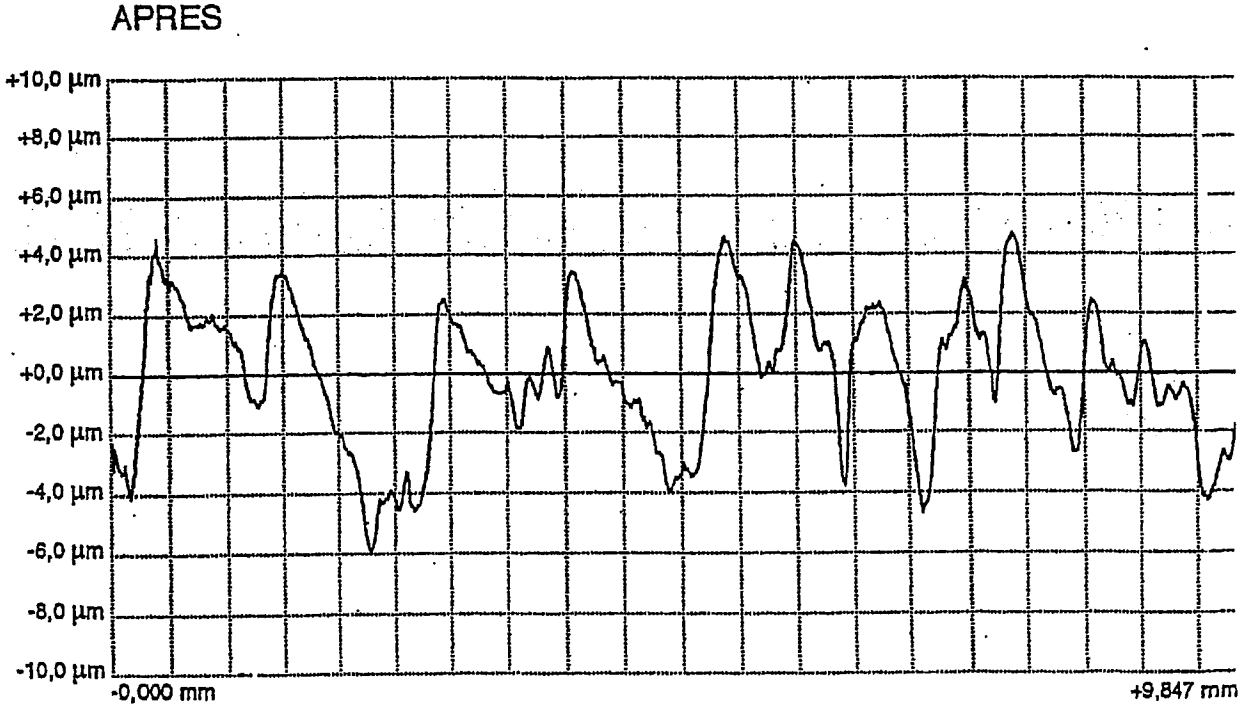
-6,0 µm
-8,0 µm
-10,0 µm
-12,0 µm
+0,000 mm
+9,851 mm

FIG.6


APRES
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+6,0 µm
+4,0 µm
+2,0 µm
+0,0 µm
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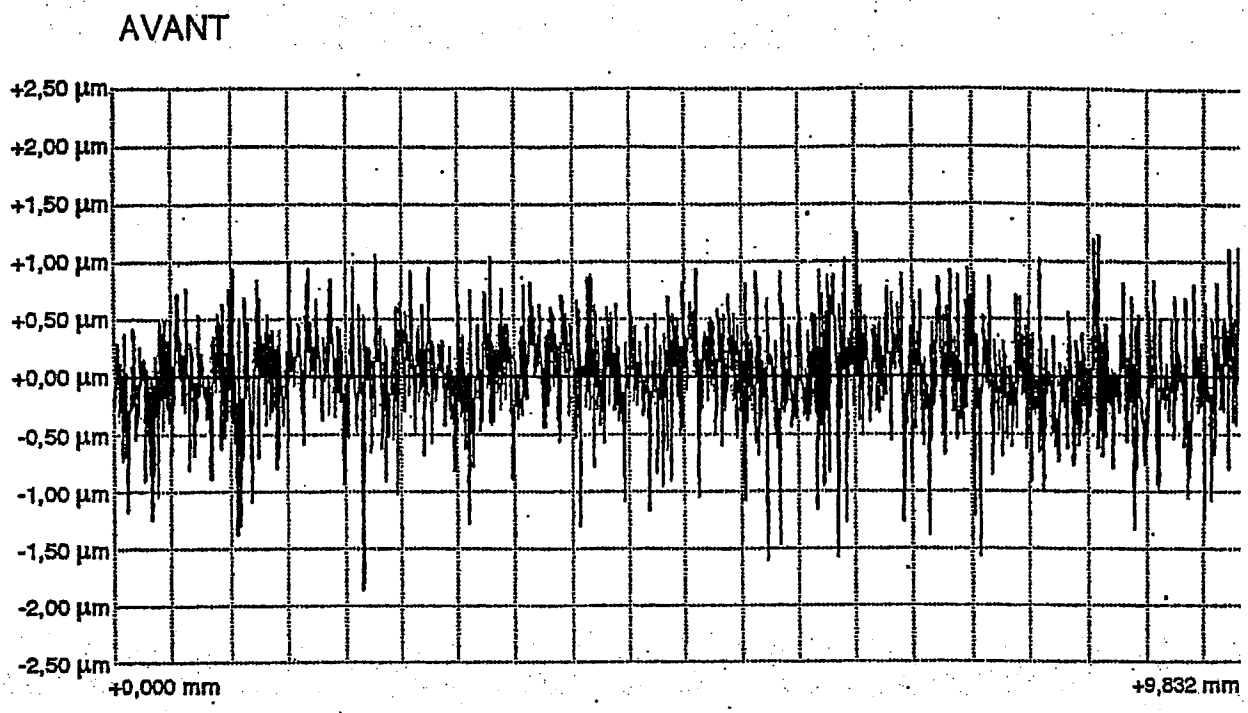
-4,0 µm
-6,0 µm
-8,0 µm
-10,0 µm
-0,000 mm
+9,847 mm

FIG.7


AVANT
+2,50 µm
+2,00 µm
+1,50 µm
+1,00 µm
+0,50 µm
+0,00 µm
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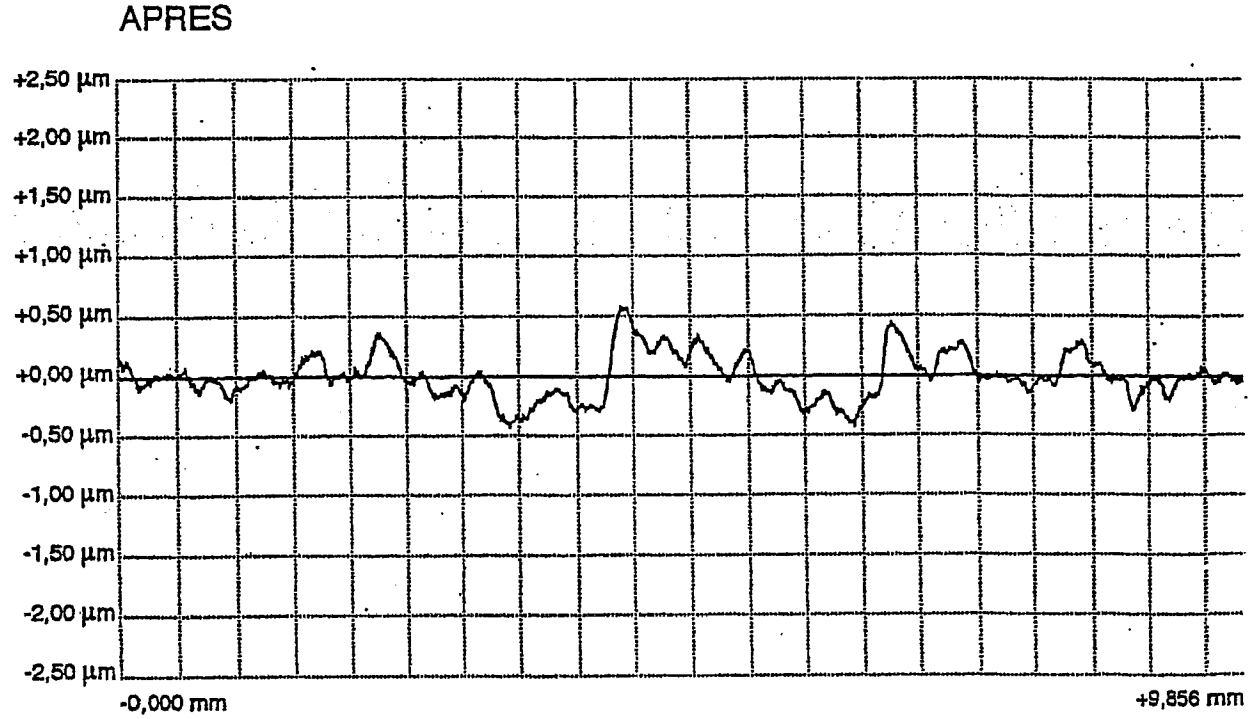
-1,00 µm
-1,50 µm
-2,00 µm
-2,50 µm
+0,000 mm
+9,832 mm

FIG.8


APRES
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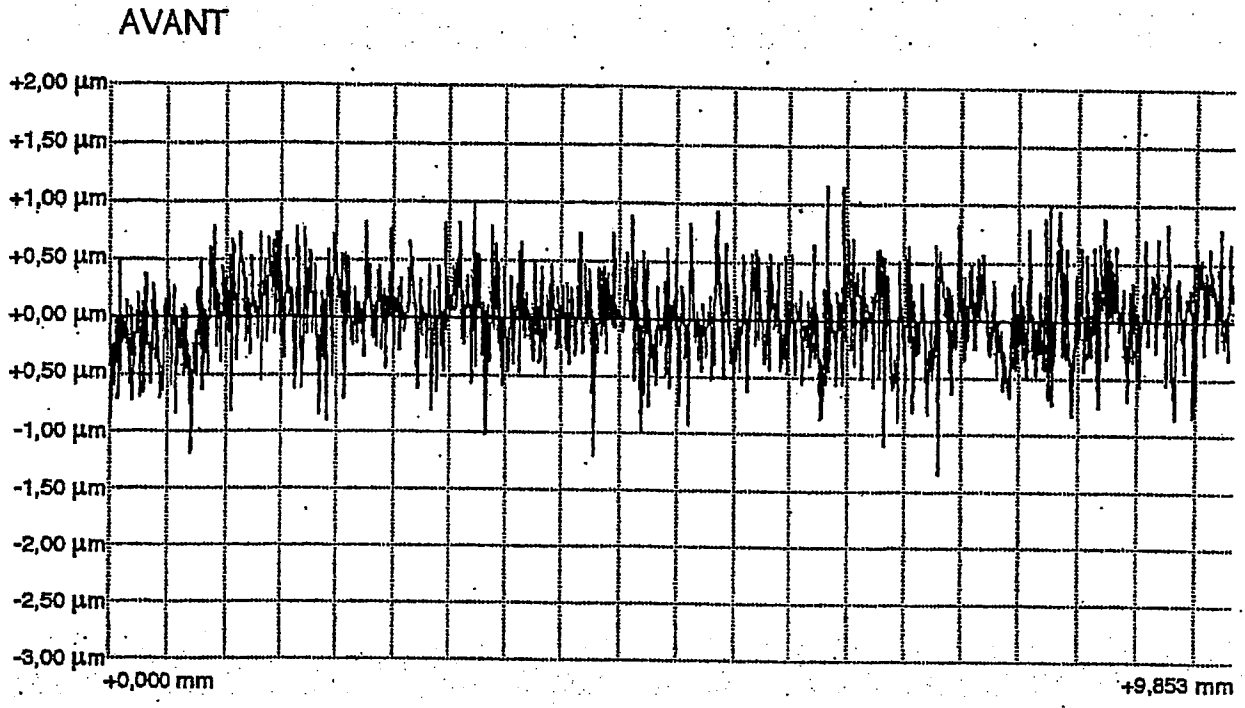
+2,00 µm
+1,50 µm
+1,00 µm
+0,50 µm
+0,00 µm
-0,50 µm
-1,00 µm
-1,50 µm
-2,00 µm
-2,50 µm
-0,000 mm
+9,856 mm

FIG.9


AVANT
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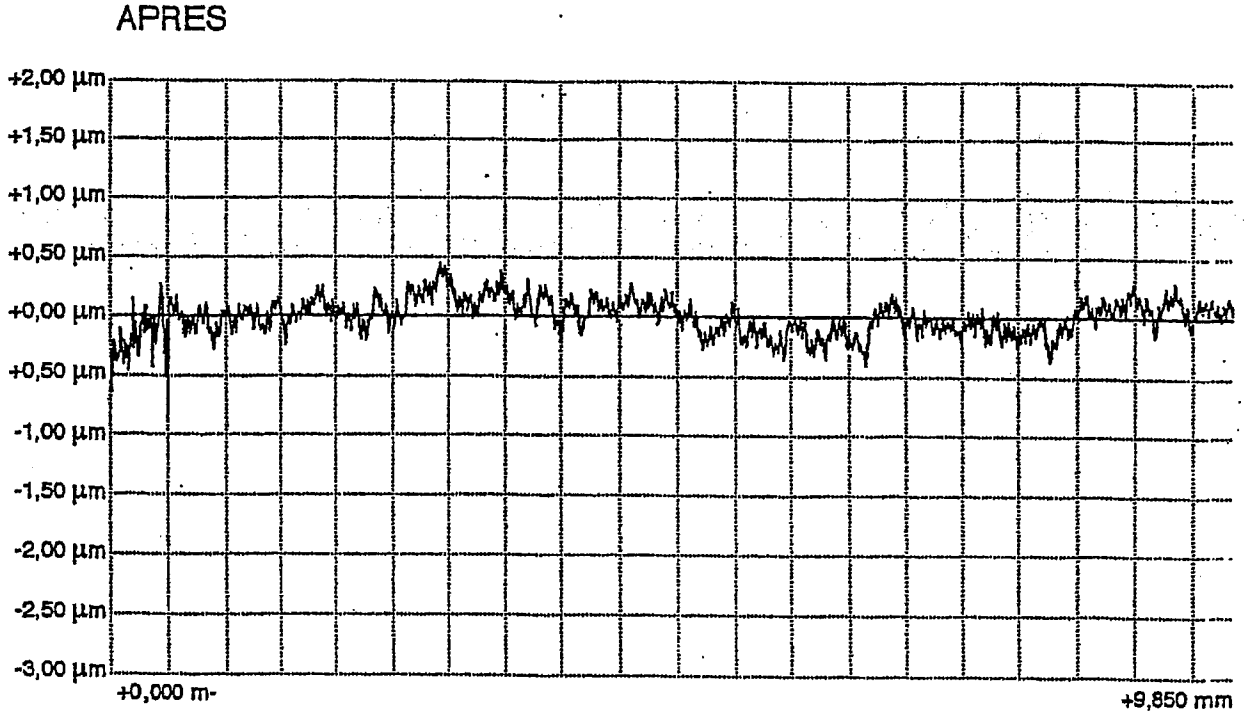
+1,50 µm
+1,00 µm
+0,50 µm
+0,00 µm
+0,50 µm
-1,00 µm
-1,50 µm
-2,00 µm
-2,50 µm
-3,00 µm
+0,000 mm
+9,853 mm

FIG.10


APRES
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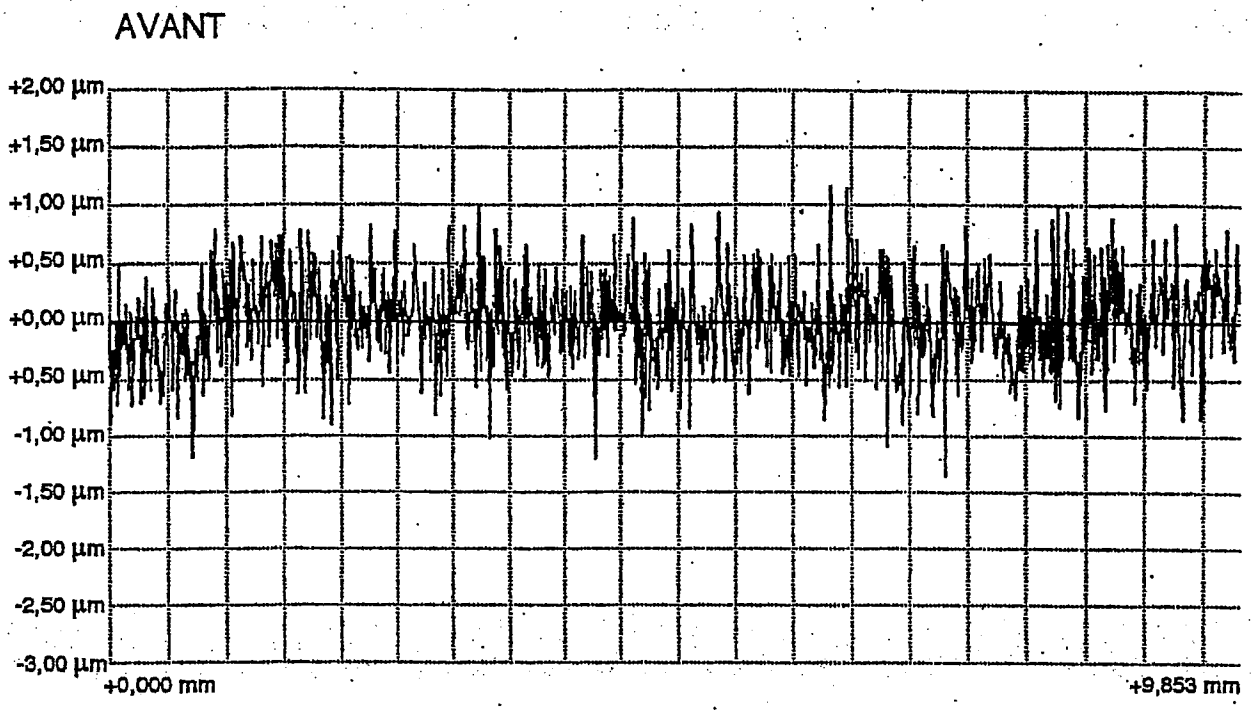
+1,50 µm
+1,00 µm
+0,50 µm
+0,00 µm
+0,50 µm
-1,00 µm
-1,50 µm
-2,00 µm
-2,50 µm
-3,00 µm
+0,000 m-
+9,850 mm

FIG.11


AVANT
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+1,00 µm
+0,50 µm
+0,00 µm
+0,50 µm
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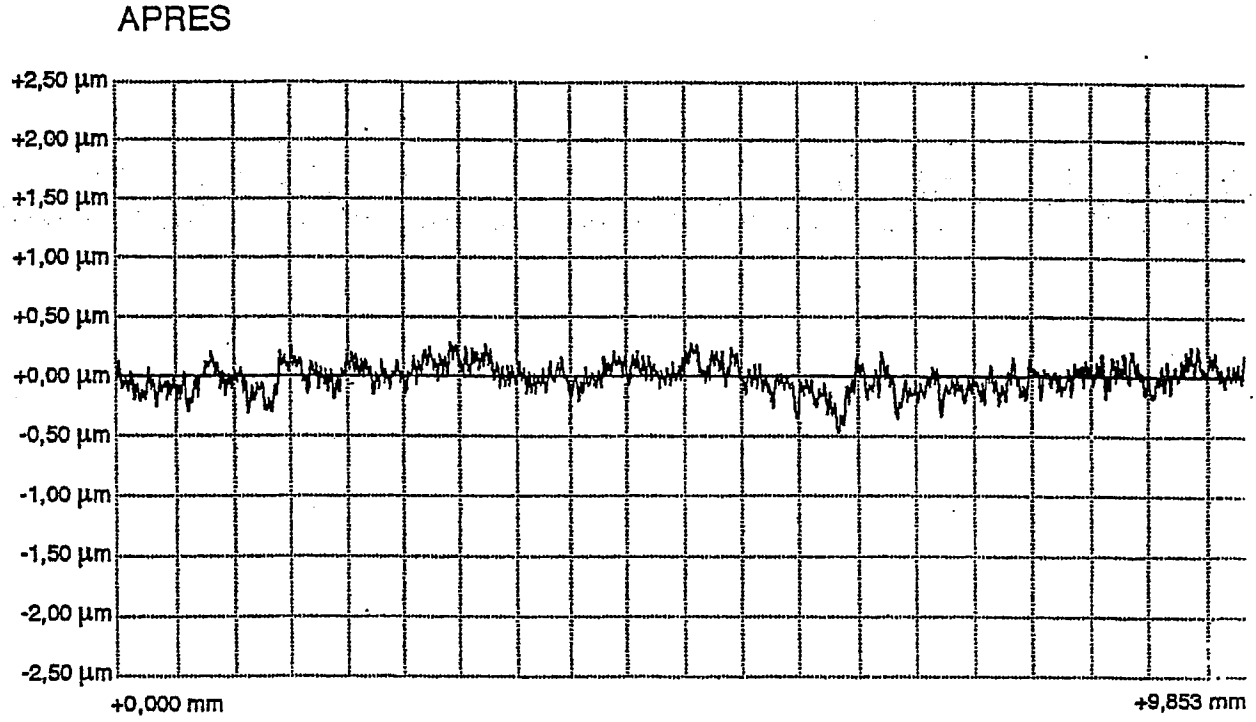
-1,50 µm
-2,00 µm
-2,50 µm
-3,00 µm
+0,000 mm
+9,853 mm

FIG.12


APRES
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+1,50 µm
+1,00 µm
+0,50 µm
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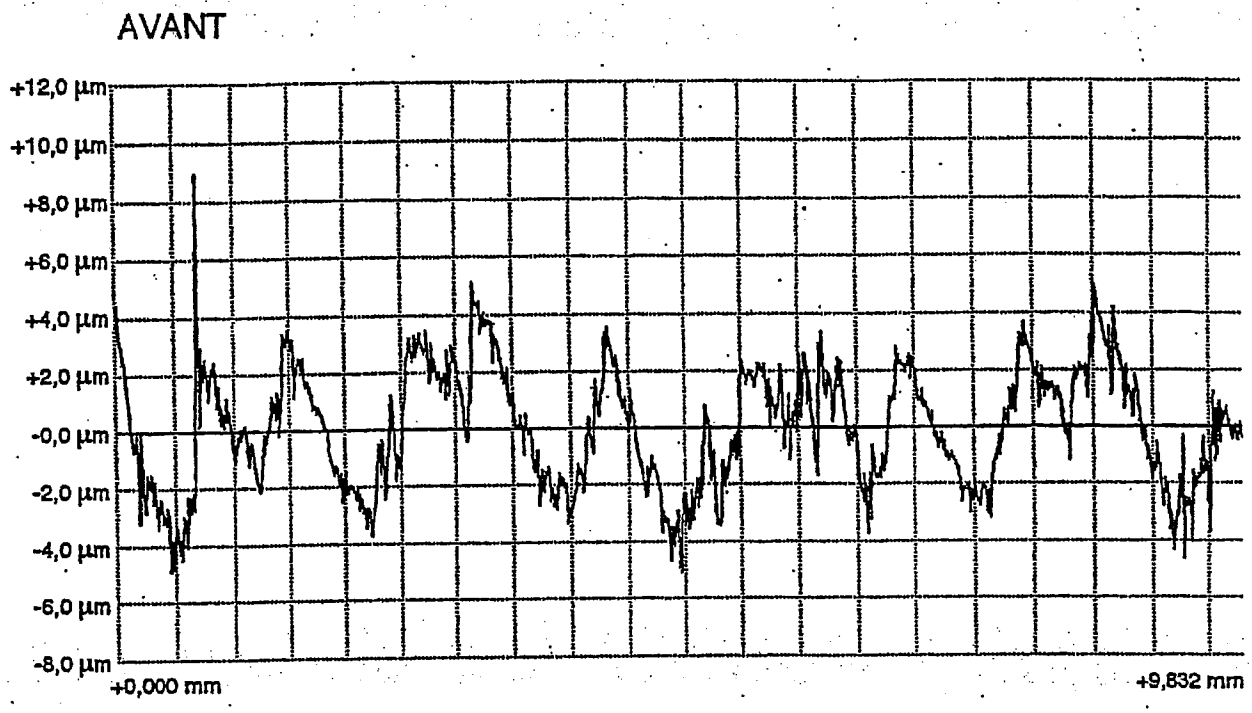
-1,50 µm
-2,00 µm
-2,50 µm
+0,000 mm
+9,853 mm

FIG.13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+8,0 µm
+6,0 µm
+4,0 µm
+2,0 µm
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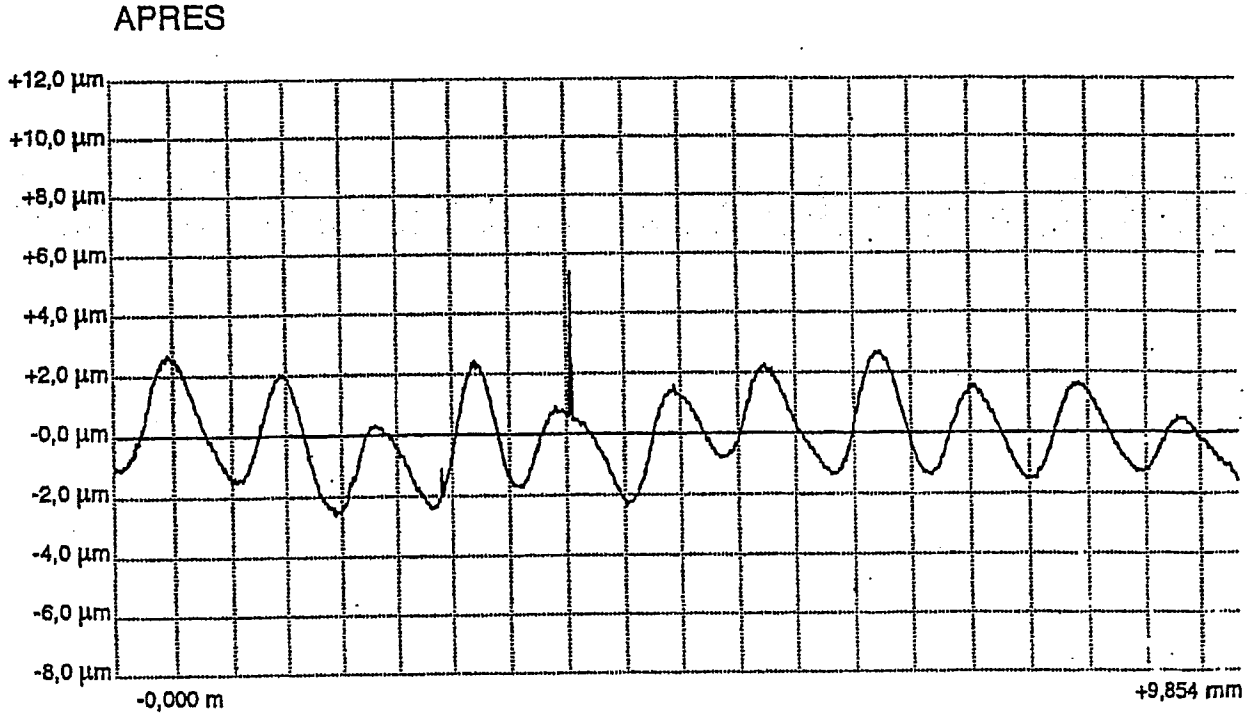
-2,0 µm
-4,0 µm
-6,0 µm
-8,0 µm
+0,000 mm
+9,832 mm

FIG.14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+6,0 µm
+4,0 µm
+2,0 µm
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-2,0 µm
-4,0 µm
-6,0 µm
-8,0 µm
-0,000 m
+9,854 mm

FIG.15

AVANT

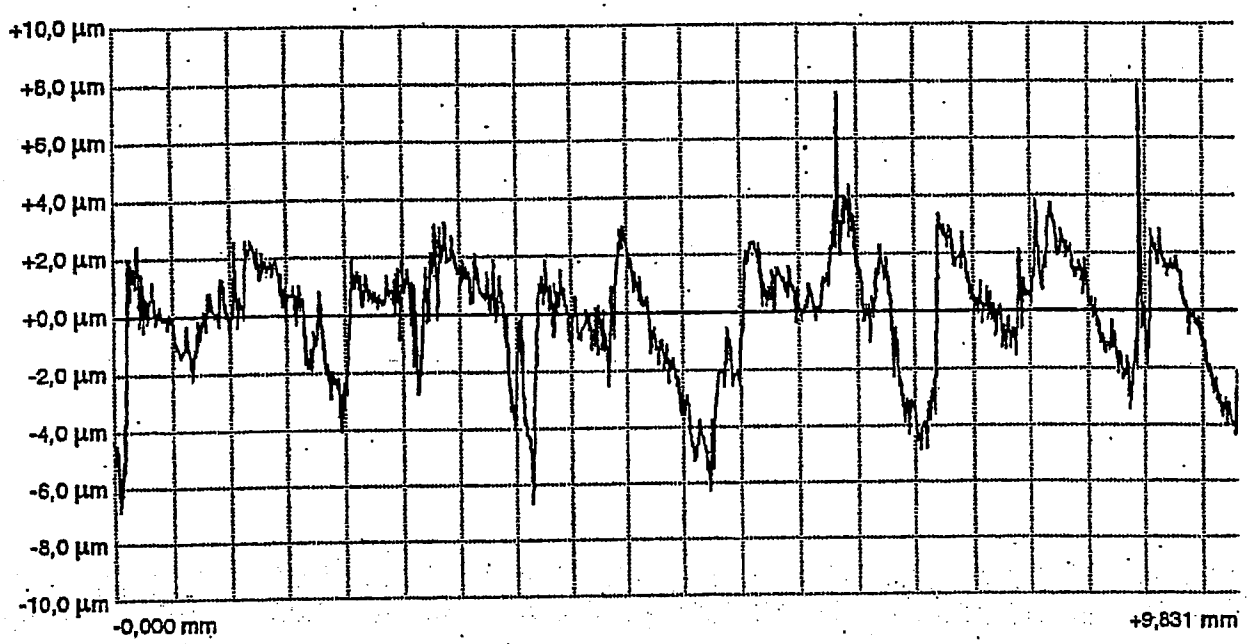



FIG.16

APRES

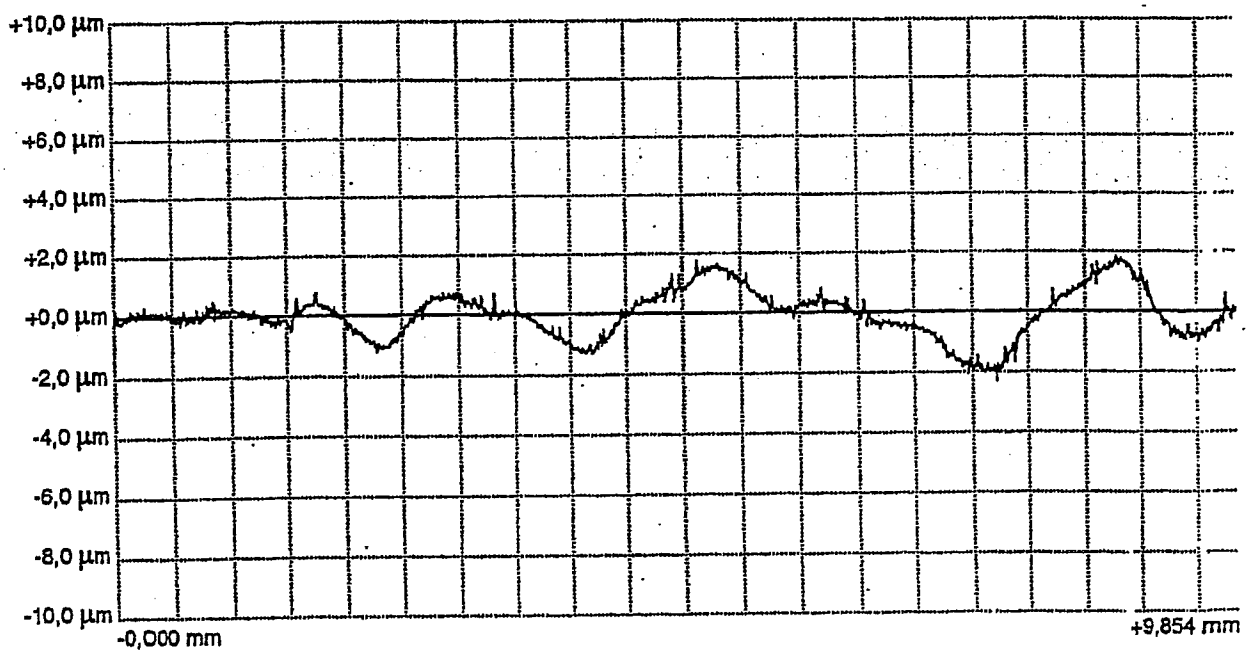
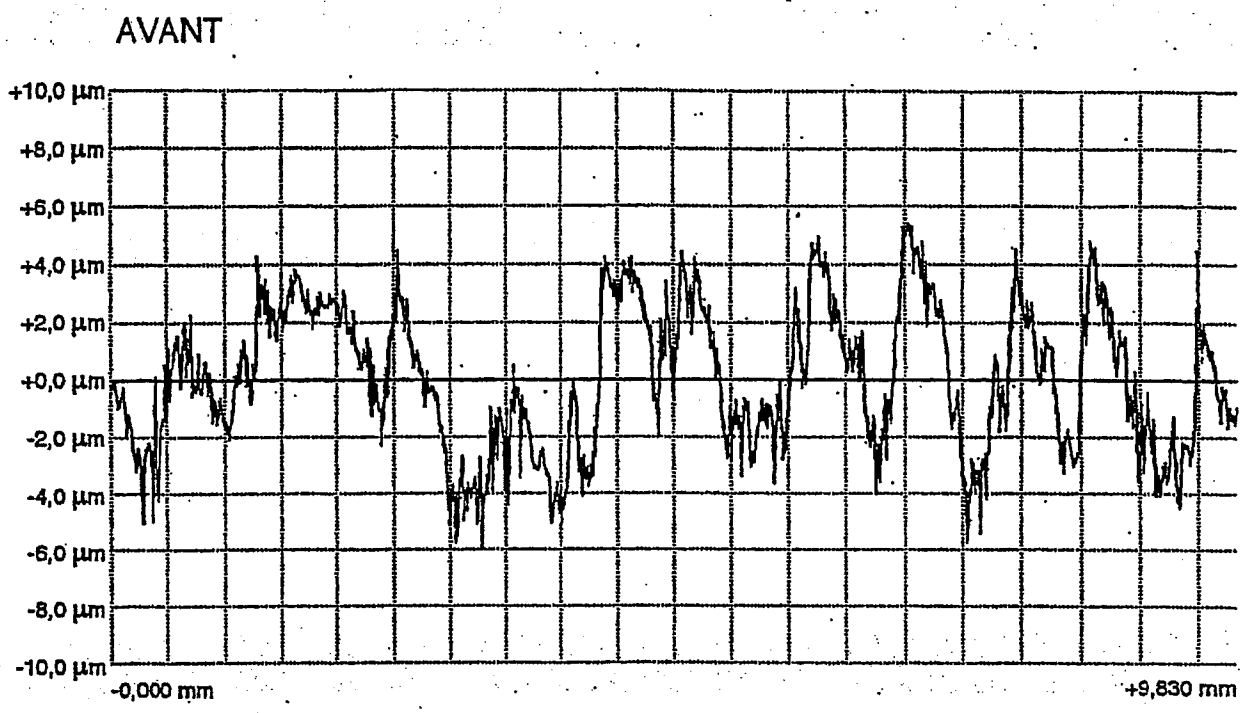


FIG.17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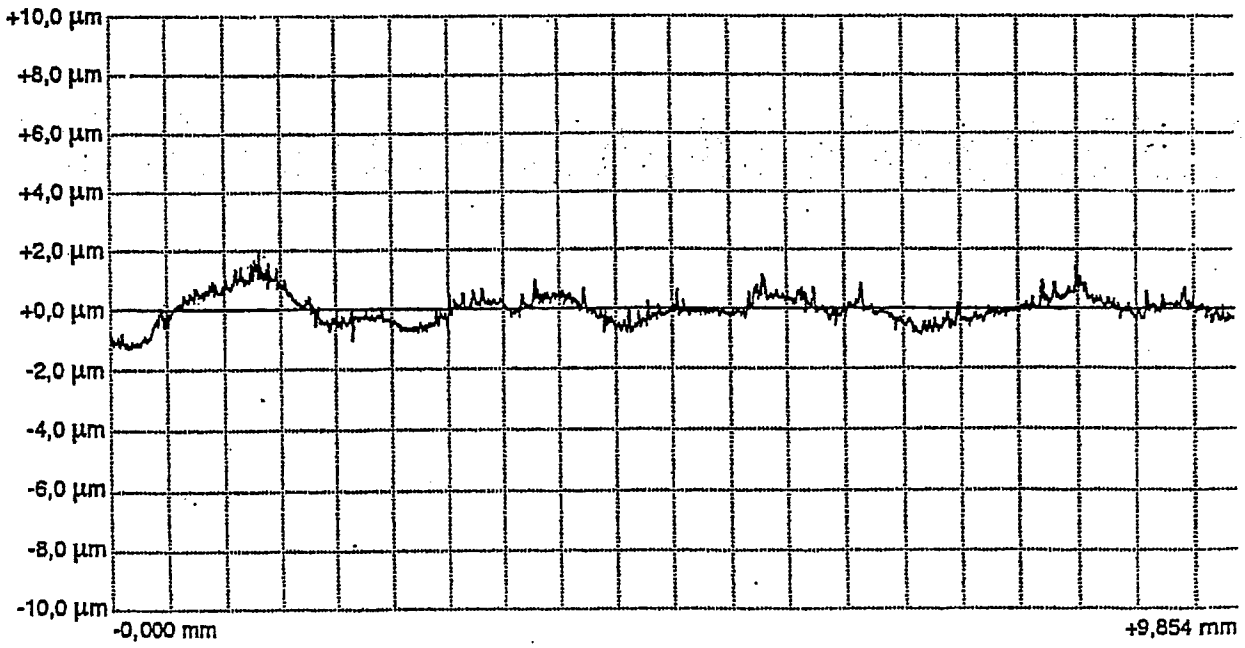
+9,830 mm

FIG.18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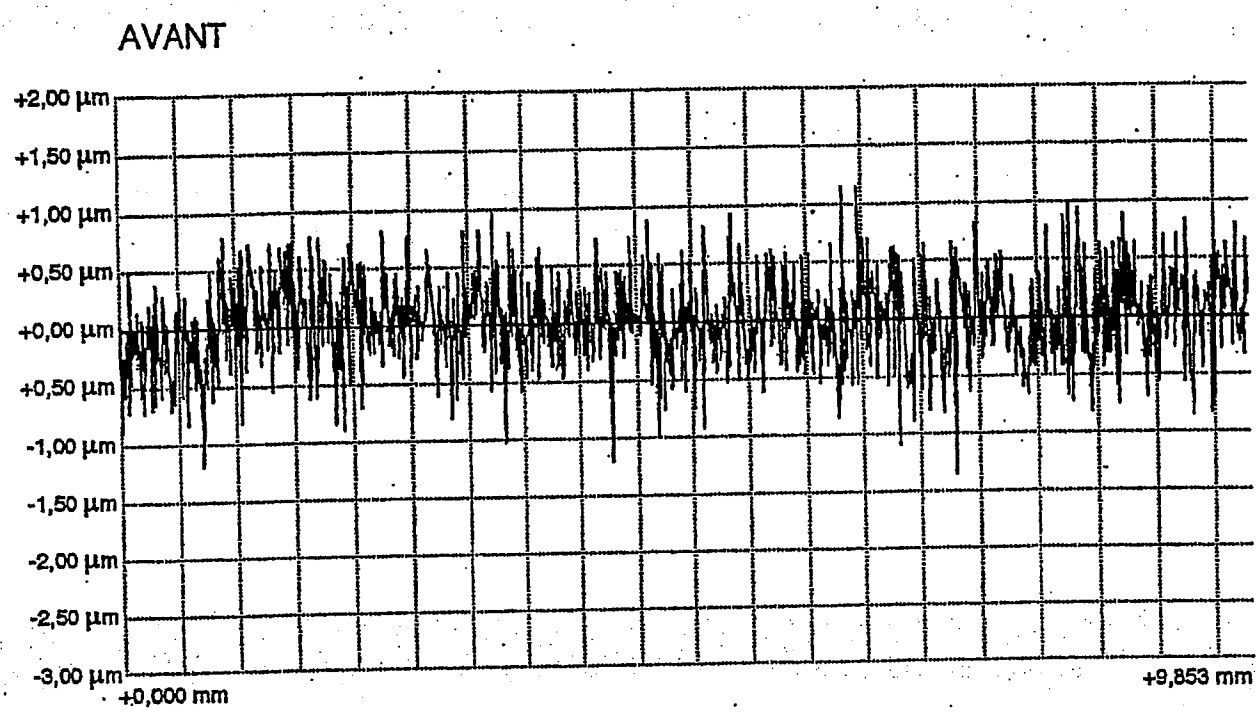
-10,0 µm
-0,000 mm
+9,854 mm

FIG.19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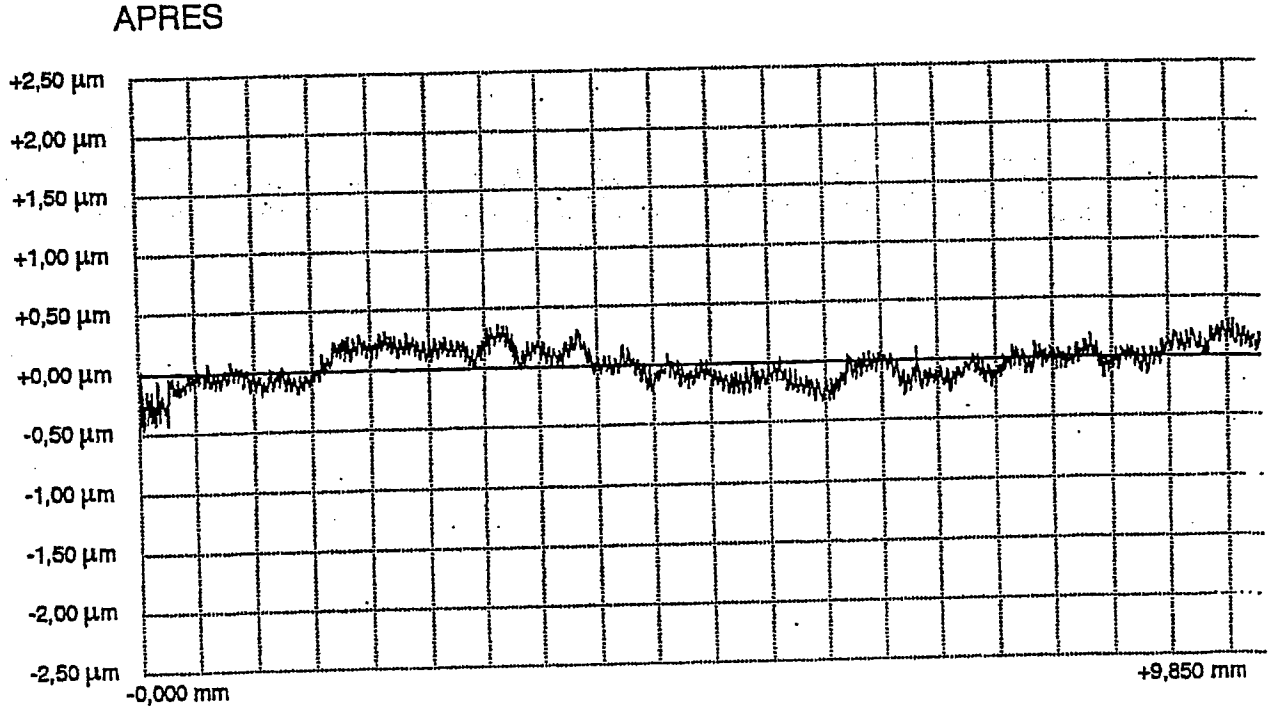
-2,50 µm
-3,00 µm
+0,000 mm
+9,853 mm

FIG.20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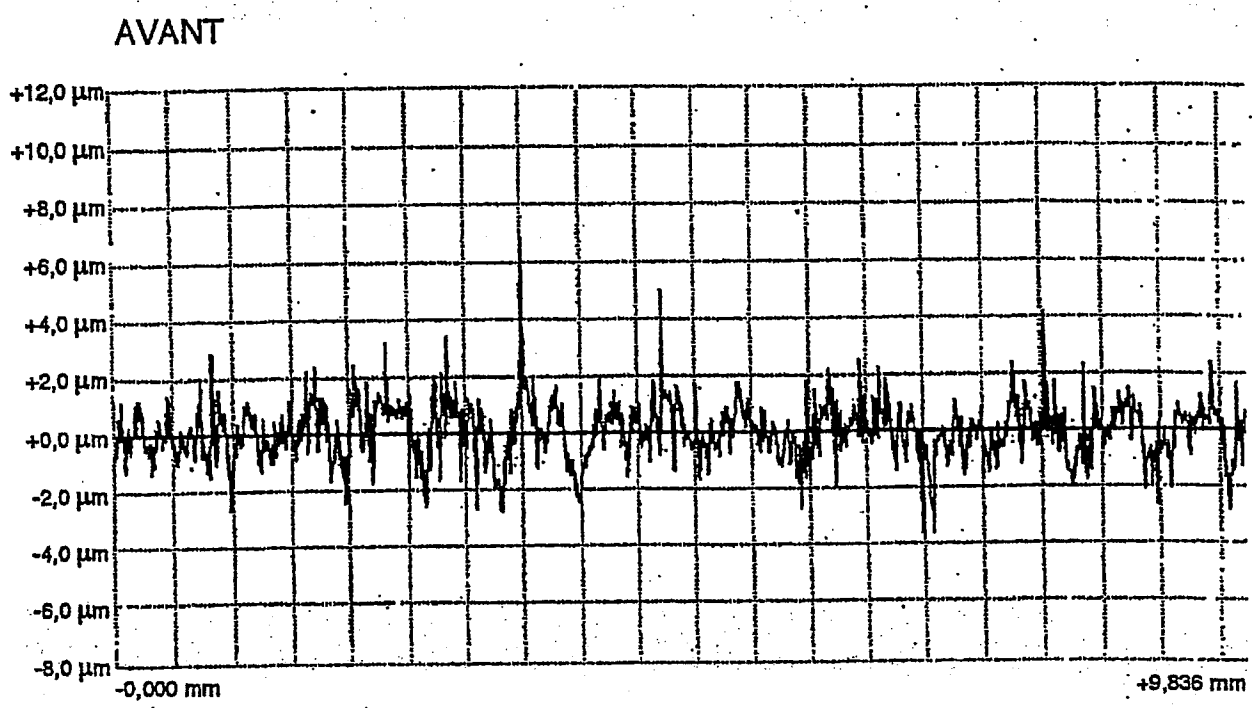
-2,50 µm
-0,000 mm
+9,850 mm

FIG.21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+6,0 µm
+4,0 µm
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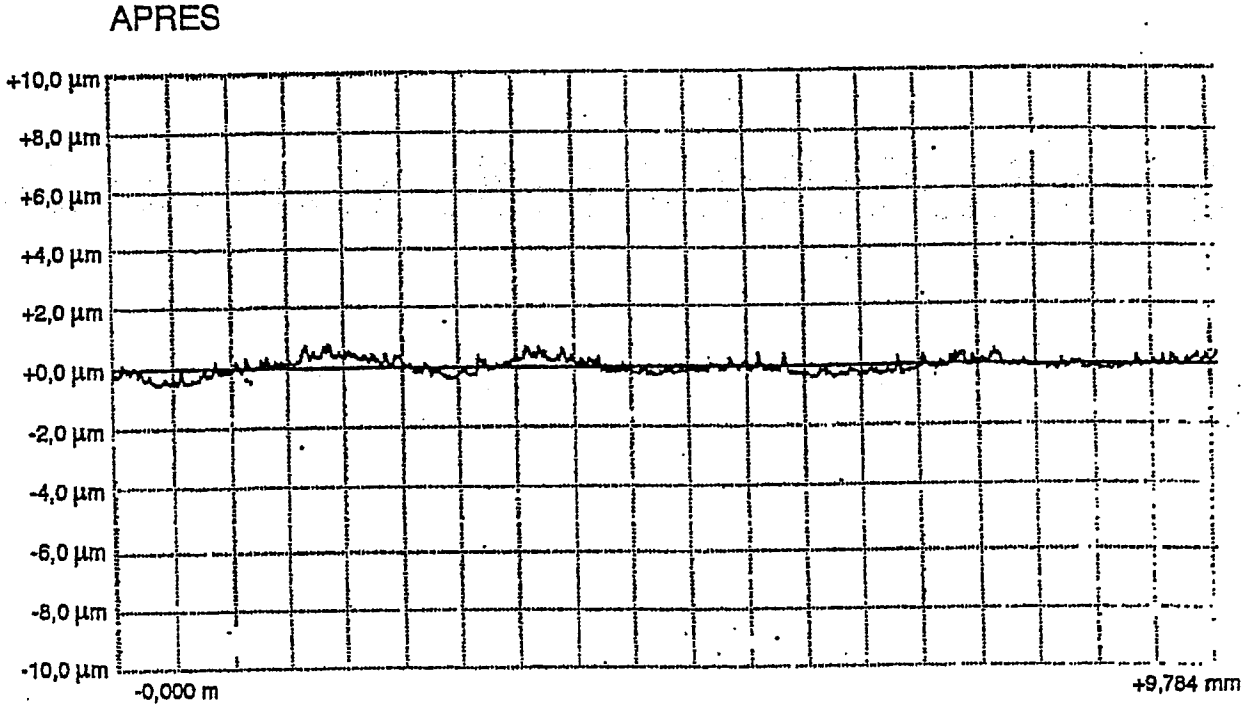
-0,000 mm
+9,836 mm

FIG.22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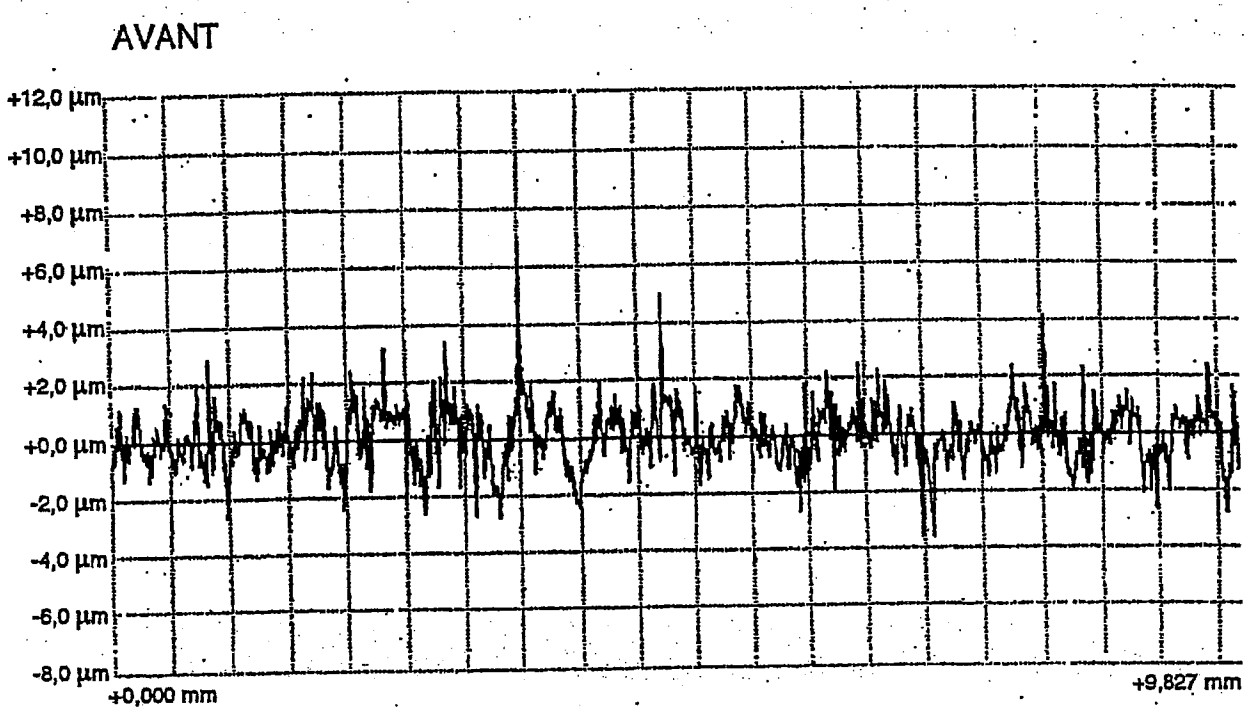
-0,000 m
+9,784 mm

FIG.23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+8,0 µm
+6,0 µm
+4,0 µm
+2,0 µm
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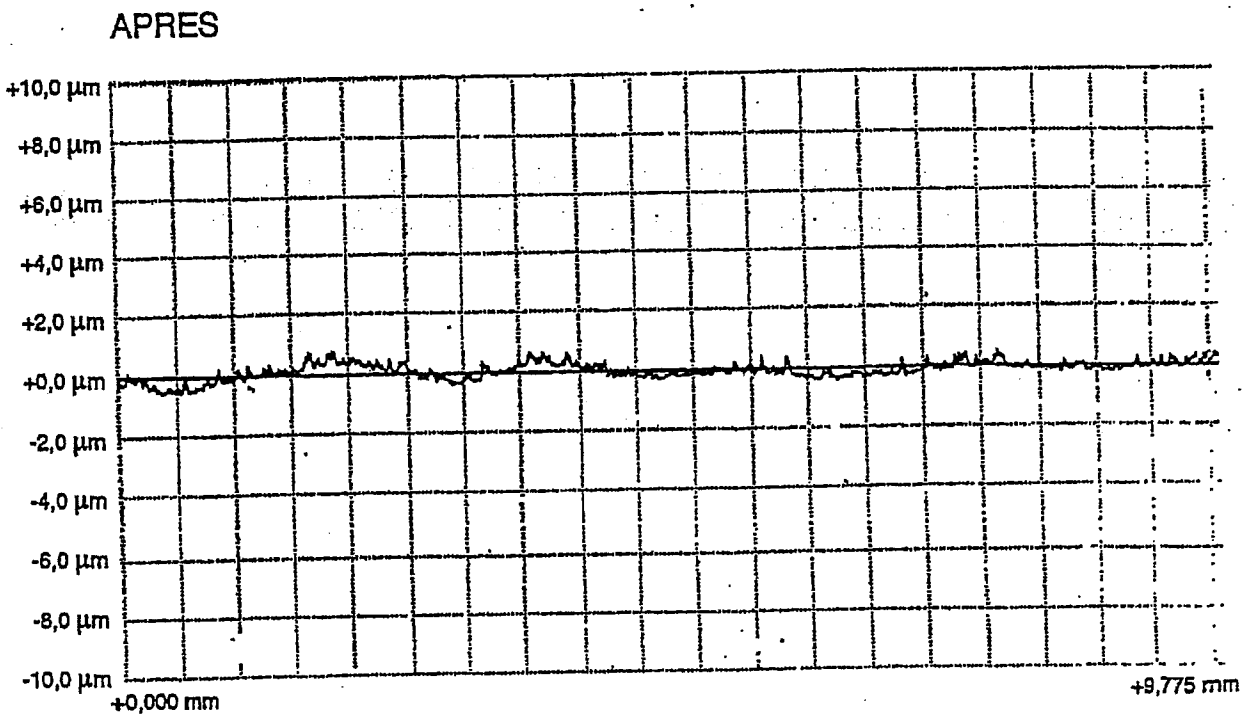
-2,0 µm
-4,0 µm
-6,0 µm
-8,0 µm
+0,000 mm
+9,827 mm

FIG.24


APRES
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-2,0 µm
-4,0 µm
-6,0 µm
-8,0 µm
-10,0 µm
+0,000 mm
+9,775 mm

# EVIDENCE APPENDIX 4
## (October 3, 2005 Office Action)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/068,232 | 02/06/2002 | Aude Prieur-Blanc | ESSR:062US | 8542 |

7590 10/03/2005

Mark B. Wilson
Fulbright & Jaworski L.L.P.
Suite 2400
600 Congress Avenue
Austin, TX 78701

| EXAMINER | |
|---|---|
| VARGOT, MATHIEU D | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 1732 | |

DATE MAILED: 10/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

FULBRIGHT & JAWORSKI, LLP
IPT DOCKETING
Docketed ☑ Not Req'd ☐ Confirmation ☐
Initials 1st JK Initials 2nd
10-20-05
Rec'd 10/10/05 pm
OCT 06 2005
Attorney MBW/MRK
Docket No. ESSR:06245
Action Req'd Date Due

3 mo OA initial
deadline 1/3/06.
Final 4/3/06.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/068,232 | PRIEUR-BLANC ET AL. | |
| | Examiner | Art Unit | |
| | Mathieu D. Vargot | 1732 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *27 July 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *18-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *18-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

1.Claims 18-34 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Applicant has amended claim 18 to recite that the fine grinding and/or polishing constitutes attacking with a solvent **but not with a non-solvent**. However, there is no support for this recitation. Applicant specifically notes page 2, lines 20-21 in the instant specification as providing support for this limitation. However, this disclosure to a non-solvent is merely a discussion of the prior art to Duchane et al in US Patent 4,376,751, which is applied as a secondary reference against the claims. Unless applicant can show somewhere else in the specification where "without a non-solvent" is specifically taught as an embodiment of the instant invention, it is respectfully submitted that the instant amendment introduces new matter which was not disclosed in the original specification. Negative limitations require clear support in the specification. The fact that applicant's specification contains a disclosure of the limitation due to a discussion of the prior art is not sufficient to enable him to positively exclude same in the claims unless there is positive support for such.

2.The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 18-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art as set forth at page 1, line 7 through page 2, line 11 of the instant specification in view of Duchane et al (col. 1, lines 40-50; col. 2, lines 45-55) for reasons of record as set forth in the previous action.

It is noted that applicant has amended the claims to recite that the fine grinding and/or polishing is done without a non-solvent. At already noted in paragraph 1, it is submitted that this is new matter. Even if such is ultimately deemed not to be new matter, it is submitted that a fair reading of Duchane et al would show that the use of the non-solvent is what allows the treated surface to become super smooth. Ie, see column 3, line 50, wherein Duchane et al is discussing the super smooth surface at a magnification of up to 1600X. Whereas the prior art of Duchane et al which might only employ a solvent (as in the instant, allegedly) might not have perfectly smooth surfaces at this magnification, it is believed that one of ordinary skill in the art would understand from this disclosure that the surfaces treated with only a solvent would have macroscopically smooth surfaces. It is submitted that these macroscopically smooth surfaces would be the instant smooth surfaces.

3.Applicant's arguments filed July 27, 2005 have been fully considered but they are not persuasive. Applicant's comments are primarily directed to—1) the instant claiming of not using a non-solvent and 2) whether the art has been properly combined. Point one has already been addressed and it is believed that such constitutes new

matter. Applicant apparently believes that the mere disclosure of the terminology "non-solvent" when discussing what the prior art teaches—and possibly since the instant application does not expressly use a non-solvent—allows the introduction of the instant recitation. Contrary to this, negative limitations require clear support. In other words, the instant specification would have to state that no non-solvent is used in the invention, or at least for one particular embodiment. The mere failure to disclose any non-solvent is not evidence enough that applicant considered such to not be within the purview of the instant invention. Concerning the second point, it is respectfully submitted that one of ordinary skill in the art would have knowledge of solvent polishing techniques and would have used these in lieu of mechanical polishing.

4.Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mathieu D. Vargot whose telephone number is 571 272-1211. The examiner can normally be reached on Mon-Fri from 9 to 6.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Colaianni, can be reached on 571 272-1196. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

M. Vargot
September 26, 2005

Mathieu D. Vargot
Primary Examiner
Art Unit 1732
9/26/05

# EVIDENCE APPENDIX 5
## (April 25, 2005 Office Action)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/068,232 | 02/06/2002 | Aude Prieur-Blanc | ESSR:062US | 8542 |

7590 04/25/2005

Mark B. Wilson
Fulbright & Jaworski L.L.P.
Suite 2400
600 Congress Avenue
Austin, TX 78701

| EXAMINER | |
|---|---|
| VARGOT, MATHIEU D | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 1732 | |

DATE MAILED: 04/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

2 mo. due to Provide Advis
Action 6/25/05. Initial deadl
RECEIVED
Date(s) Docketed: 3 mo. OA 7/25/05 -
Final deadline for Final
OA 10/25/05. Notice of Appeal
7/25/05. Final Notice of Appe
APR 27 2005 10/25/0
mm 4/28/05
Client: ESSR:062US
Attorney(s): MBW, MKK
Initials:

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/068,232 | PRIEUR-BLANC ET AL. | |
| | Examiner | Art Unit | |
| | Mathieu D. Vargot | 1732 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *06 April 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *18-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *18-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

1.As discussed with Mr. Krawzsenek in December, the finality of the last action would be withdrawn and it hereby has.

2.The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 18-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art as set forth at page 1, line 7 through page 2, line 11 in view of Duchane (see col. 1, lines 40-50; col. 2, lines 45-55) generally for reasons of record as set forth in paragraph 1 of the previous action.

3.Applicant's arguments filed April 6, 2005 have been fully considered but they are not persuasive. Applicant contends that the examiner has failed to provide a prime facie case of obviousness and such is simply not persuasive. Duchane et al does indeed teach that a mixture of a solvent and a non-solvent provides the smoothest surface. However, this is characterized in the reference, as applicant admits, as a "super-smooth" surface. One of ordinary skill in the art, not requiring such a "super-smooth" surface, would have expected that solvents themselves would have been a ready substitute for mechanical polishing. Also, note that the instant claims are set forth in "open" language, wherein the instant claiming of a solvent would be met by Duchane's disclosure of a solvent and non-solvent. Given that Duchane et al realizes that mechanical grinding is not that efficient as a method for polishing, one of ordinary

skill in the art would have been directed to employing a solvent. Also, it is not impermissible to use applicant's disclosure insofar as admissions of prior art, which is what is being done in the instant case. The use of a solvent as a substitute for mechanical polishing is in fact taught in Duchane et al (albeit, with a non-solvent to obtain "super-smooth" surfaces) to obtain smooth surfaces and applicant's specification is not being relied upon for any motivation to combine. Obviousness only requires a reasonable expectation of success and such has been shown. Applicant apparently is also arguing, or attempting to argue, a showing of unexpected results at page 9 of the response. The data shown in the instant specification at page 12 to 14 is directed to solvent centrifugation using certain temperatures and process parameters which are not in the claims. Any showing of unexpected results must be commensurate in scope with the claims, if that is what applicant is attempting to argue. Note that the admitted prior art shows the successive steps to be known. Duchane et al is merely being relied upon to teach the obviousness of replacing a mechanical polishing with a solvent-induced polishing, which the reference does indeed teach.

4.**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

5.Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mathieu D. Vargot whose telephone number is 571 272-1211. The examiner can normally be reached on Mon-Fri from 9 to 6.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Colaianni, can be reached on 571 272-1196. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

M. Vargot
April 21, 2005

M. Vargot
Mathieu D. Vargot
Primary Examiner
Art Unit 1732

4/21/05

# EVIDENCE APPENDIX 6
## (October 6, 2004 Office Action)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/068,232 | 02/06/2002 | Aude Prieur-Blanc | ESSR:062US | 8542 |

7590 10/06/2004

Mark B. Wilson
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Suite 2400
600 Congress Avenue
Austin, TX 78701

| EXAMINER | |
|---|---|
| VARGOT, MATHIEU D | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 1732 | |

DATE MAILED: 10/06/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

2 month due date to Provoke Advisory Action 12-06-04 10/12/04
Initial deadline for Final OA - 01-06-05

Final deadline for Final OA - 04-06-05
Initial deadline for Notice of Appeal - 01-06-05
Final deadline for Notice of Appeal - 04-06-05

ESSR: 062US
MBW/MRK
dw

FULBRIGHT & JAWORSKI LLP
AUSTIN, TEXAS

OCT 0 8 2004

RECEIVED

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/068,232 | PRIEUR-BLANC ET AL.3 | |
| | Examiner | Art Unit | |
| | Mathieu D. Vargot | 1732 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *01 July 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *18-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *18-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

1.The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 18-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art as set forth in the instant specification at page 1 line 7 through page 2, line 11 in view of Duchane (see col. 1, lines 40-50; col. 2, lines 45-55). The admitted prior art teaches that the instant **successive** steps of grinding, fine grinding and polishing are well known in the art and are indeed applied to optical articles such as lenses. Essentially, the admitted prior art fails to teach that the final mechanical steps of the grinding—ie, the fine grinding and/or the polishing—would be replaced with an attack of the principal surface of the article with a solvent or mixture of solvents. As set forth in the previous action, Duchane discloses obtaining super smooth plastic surfaces for optical articles including lenses **by doing exactly that**— ie, attacking the plastic surface with a solvent. Note further the above-noted passages of Duchane (ie, col. 1, lines 40-50 and col. 2, lines 45-55), which clearly indicate that the solvent treatment is to replace a diamond knife machining, such being disclosed in the admitted prior art as fine grinding. Clearly, Duchane is solving the instant problem—ie, that disclosed at instant page 3, lines 7-11 -- with the instant solution—ie, the use of solvents instead of mechanical grinding or polishing. It certainly would have been obvious to one of ordinary skill in this art to replace either the fine grinding and/or the polishing of the admitted prior art with the solvent attack of Duchane for the very reason

noted in Duchane and indeed by applicant—namely, to reduce costs due to equipment and to obtain an even smoother surface than would be attainable using mechanical means. The centrifugation and solvent vapor attack are rejected essentially for reasons already given in the first action.

2.Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

In view of the amendment requiring the steps to be successive, a new rejection has been applied, with the admitted prior art now the primary reference and Duchane being relied upon to teach what is missing therefrom. In essence, however, Duchane is still being relied upon to teach what the reference was being relied upon to teach in the first action. Arguments directed to the failure of Duchane to teach each and every limitation are now moot in view of the combination, which does teach all claim limitations. Likewise, the motivation to combine has now been expressly set forth—ie, the solving of the same problem with the same solution is ample evidence of obviousness.

3.Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

4.Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mathieu D. Vargot whose telephone number is 571 272-1211. The examiner can normally be reached on Mon-Fri from 9 to 6.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Colaianni, can be reached on 571 272-1196. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

M. Vargot
October 4, 2004

M. Vargot
Mathieu D. Vargot
Primary Examiner
Art Unit 1732

10/4/04

# EVIDENCE APPENDIX 7
**(January 2, 2004 Office Action)**

KB

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/068,232 | 02/06/2002 | Aude Prieur-Blanc | ESSR:062US | 8542 |

7590 01/02/2004

Mark B. Wilson
Fulbright & Jaworski L.L.P.
Suite 2400
600 Congress Avenue
Austin, TX 78701

| EXAMINER | |
|---|---|
| VARGOT, MATHIEU D | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 1732 | |

DATE MAILED: 01/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

RECEIVED
Date(s) Docketed: 1/2/04 Response
to Office: 1/2/04
final deadline
JAN 05 2003
Client: ESSR:062US
Attorney(s): MBW
Initials: DN SS

pm 1/8/04

A-5

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/068,232 | PRIEUR-BLANC ET AL. | |
| | Examiner | Art Unit | |
| | Mathieu D. Vargot | 1732 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *06 February 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *18-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *18-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. §§ 119 and 120**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *4/9/02* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

1.Claims 18-34 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 18, it should be clearly set forth that the surface polishing comprises the steps of grinding followed by a fine grinding and/or polishing, if that is what applicant intends. As the claim is written, it is difficult to tell if all the grinding/polishing steps are required. It is being assumed that applicant desires an initial grinding step which is then followed by a fine grinding and/or polishing, since the latter two are apparently the same. Also, in claim 29, the recitation "attacking by centrifugation" should be amended to –attacking by centrifugation of the solvent or mixture of solvents—and "with a vapor phase" should be –with a vapor phase of solvent or mixture of solvents— for clarity—certainly, it is not just the centrifugation which performs the attacking, but the centrifugation of the solvent(s). The same for the vapor phase attack. Claims 30 and 31 should also be amended.

2.The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 18-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Duchane (see col. 2, lines 48-55; col. 3, lines 3-5).

Duchane discloses that articles such as lenses can be made super smooth by a solvent polishing and that it is known in the art to employ diamond knife machining, or grinding,

to prepare a smooth surface on plastic articles. Essentially, the applied reference lacks a clear teaching that the two steps would be performed together on a lens and the other aspects of the invention such as centrifuging the solvent and/or using a solvent vapor. First of all, it is well known in the art to perform a diamond lathe turning or grinding of lens surfaces after making the lens. Given that Duchane discloses that the solvent treatment would provide even a smoother surface than such turning, one of ordinary skill in the art would have found doing both as obvious, the grinding to bring the lens surface to the approximate smoothness and surface shape desired followed by the solvent treatment to obtain a lens of super smooth surface and superior light transmission. See column 3, lines 3-5. While Duchane discloses lenses made of acrylic in this passage, polycarbonate as a thermoplastic is disclosed at column 6, line 14 and polycarbonate is a well known material for plastic lens production. Suitable solvents are also set forth in column 6, lines 12+. Duchane keeps the solvent bath in motion and one of ordinary skill in this art would have found a centrifuging to be an obvious expedient over continuously circulating the bath, as either would provide a constant replenishing of the necessary solvent on the article as its principal surface is being smoothed. Duchane also discloses that the bath can be heated (col. 7, lines 43-45) and it is submitted that providing a vapor phase for the solvent would have been obvious thereover. It is generally well known in the solvent smoothing art that liquids as well as vapors can be used. To combine both the centrifuging and the vapor treatment would have been obvious for a synergistic effect.

3.The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Stuart discloses refinishing the body of a thermoplastic by exposing same to solvent vapors. Norville discloses smoothing plastic surfaces using an abrasive paste to improve clarity and optical quality. Bango, Jr (-797 and –526) teach application of solvents to plastic optical disk surfaces to eliminate scratches and smooth the surfaces thereof.

4.Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mathieu D. Vargot whose telephone number is 703 272-1211. The examiner can normally be reached on Mon-Fri from 9 to 6.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Colaianni, can be reached on 571 272-1196. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308-0661.

M. Vargot

M. Vargot
December 27, 2003

Mathieu D. Vargot
Primary Examiner
Art Unit 1732

12/27/03

| Notice of References Cited | Application/Control No. 10/068,232 | Applicant(s)/Patent Under Reexamination PRIEUR-BLANC ET AL. | |
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Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

| Form PTO-1449 (modified) | Atty. Docket No. ESSR:062US/MBW | Serial No. 10/068,232 |
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| List of Patents and Publications for Applicant's INFORMATION DISCLOSURE STATEMENT (Use several sheets if necessary) | Applicant Aude Prieur-Blanc Jean-Paul Cano | |
| | Filing Date: February 6, 2002 | Group: 1732 |



| U.S. Patent Documents | Foreign Patent Documents | Other Art |
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| *See Page 1* | *See Page 1* | *See Page 1* |

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| EXAMINER: M. Vaughn | DATE CONSIDERED: 12/27/03 |
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